Chapter 9

Sources of Structural Complexity: The Technical Core

Every organized human activity—from the making of pots to the placing of a man on the moon—gives rise to two fundamental and opposing requirements: the division of labor into various tasks to be performed, and the coordination of these tasks to accomplish the activity. The structure of an organization can be defined simply as the sum total of the ways in which it divides its labor into distinct tasks and then achieves coordination among them.

Henry Mintzberg (1979)

Whether by natural or rational selection—by evolution or learning—organizations tend to move toward higher levels of complexity. This thesis will be amplified at two levels. First, in this chapter we examine the sources of structural complexity that develop within the technical core of an organization. The prime source of core complexity is the nature of the work being carried out—the demands made by the technology on the structure. Second, in Chapter 10 we consider the sources of structural complexity that occur outside the technical core, in the peripheral sectors of the organization, including the managerial and institutional levels. These structures respond in particular to demands posed by the size or scale of the organization and to the task and institutional environments. At the conclusion of Chapter 10 we examine the relation between the core and peripheral structures.

The structural features of organizations that are of primary interest are those defining the division of labor—structural differentiation, including occupational and role specialization, departmentalization, and multidivisional forms—and those relating to coordination and control of work—formalization, hierarchy, centralization, and various structures for facilitating lateral information flows.

Contingency theory provides the primary orienting framework for the topics addressed in this chapter. As described in Chapter 4, this approach insists that there is no single best way in which to design the structure of an organization. Rather, what is the best or most appropriate structure depends—is contingent—on what type of work is being performed and on what environmental demands or conditions confront the organization. Lawrence and Lorsch and Jay Galbraith utilize a rational open perspective and stress formalized responses to task complexity. Other theorists, such as the Tavistock group, Burns and Stalker, Cole, and Ouchi, assume a natural open system perspective and emphasize the value of more diffuse and informal control systems. Both groups will inform our attempts to account for the complexity of the technical core.

To the extent possible, organizations attempt to seal off their technical core from environmental disturbances. This central proposition developed by Thompson (1967) helps to account for the defensive behavior of many types of organizations. The specific strategies devised by organizations to buffer their technical core were reviewed in the previous chapter. But what if the buffers are inadequate and uncertainty penetrates the technical core? As organizations take on more complex and unpredictable tasks, we cannot assume that all traces of uncertainty will be buffered out of the core. How can the structure of the technical core be modified so as to accommodate more demanding tasks? To address this question, we need to develop a clearer conception of how to define and measure the work performed in the technical core.

DEFINING AND MEASURING TECHNOLOGY

As we pointed out in Chapter 1, *technology* is the term that has come to refer to the work performed by an organization. This concept is broadly defined by organization theorists and includes not only the hardware used in performing work but also the skills and knowledge of workers, and even the characteristics of the objects on which work is performed. We must acknowledge at the outset that there is considerable overlap between *technology*, *technical system*, *task environment*, and *environment* as these terms are employed by organizational analysis. *Environment* is the more inclusive term and incorporates political, technological, and institutional aspects of the organizational context. *Task environment* emphasizes those features of the environment relevant to its supply of inputs and its disposition of outputs but also includes the power-dependence relations within which the organization must make its exchanges. *Technology* refers to "the physical com-

bined with the intellectual or knowledge processes by which materials in some form are transformed into outputs" (Hulin and Roznowski, 1985: 47). It is important to emphasize the extent to which an organization's technology—although an "internal" element—links the organization to its environment: the environment not only is the source of inputs and the recipient of outputs but also is the major source of the work techniques and tools employed by the organization. Most organizations do not themselves invent their technologies but import them from the environment. Also, given the degree of overlap between the concepts of technology and environment, it should not surprise us to find many of the same analytical dimensions being used by analysts to identify their relevant features. Finally, *technical system* refers to "a specific combination of machines and methods employed to produce a desired outcome." (Sproull and Goodman, 1990: 255) The distinction between technology and technical system calls attention to the difference between the general state of knowledge in some domain and the particular manner in which that knowledge is deployed and embedded in a given work situation. Technology constrains but does not dictate the precise configuration of machines and methods that make up a specific technical system (see Berniker, 1987; Weick, 1990).

Earlier students of industrial and organizational sociology noted the impact of technical and production features of the work process on worker behavior and work group structure (for example, Sayles, 1958; Trist and Bamforth, 1951; Walker and Guest, 1952; Whyte, 1948). But it was the empirical research of Woodward (1958; 1965) and a theoretical article by Thompson and Bates (1957) that first called attention to technology as a general determinant of organizational structure. Woodward's conception of technology as applied to industrial organizations was broadened and generalized by Thompson (Thompson and Bates, 1957; Thompson, 1967), by Litwak (1961), and by Perrow (1967; 1970) so as to be applicable to all types of organizations.

An examination of the many recent attempts to define and measure technology indicates that the concept has been viewed very broadly to include (1) the characteristics of the *inputs* utilized by the organization; (2) the characteristics of the *transformation processes* employed by the organization; and (3) the characteristics of the *outputs* of the organization.[1] Alongside this view of technologies varying by stage of processing, Hickson, Pugh, and Pheysey (1969) point out that approaches to technology vary by whether analysts emphasize (1) the *materials* on which work is performed, (2) the *operations* or techniques used to perform the work, or (3) the state of *knowledge* that underlies the transformation process. If these two sets of distinctions are cross-classified, they allow us to both categorize and summarize

[1]A large number of output measures has been developed by the Aston group—a team of researchers working at the University of Aston in Birmingham, England (see Pugh et al., 1969: 99–102). These researchers regard their measures as relating to the concept of *charter*—the social function or goals of an organization—rather than to an organization's technology. In fact, though, many of the measures relate to the characteristics of outputs—for example, multiplicity of products and degree of customization—and so from our point of view are appropriate measures of technology.

many of the specific measures that have been employed to assess organizational technologies. The classification together with illustrative measures appears in Table 9–1.

Although a great many specific measures of technology have been generated, it is possible to identify three general underlying dimensions that encompass most of the more specific measures and, more to the point, isolate the most critical variables needed to predict structural features of

TABLE 9–1
Classification of Technology Measures. *Source*: Adapted from Scott (1975), pp. 5–6.

FACETS OF TECHNOLOGY	*STAGE OF PROCESSING*		
	Inputs	*Throughputs*	*Outputs*
Materials	Uniformity of inputs (Litwak, 1961) Hardness of materials (Rushing, 1968) Variability of stimuli (Perrow, 1970)	Number of exceptions (Perrow, 1970; Lynch, 1974) Interchangeability of components (Rackham and Woodward, 1970)	Major project changes (Harvey, 1968) Multiplicity of outputs (Pugh et al. 1969) Customization of outputs (Pugh et al., 1969)
Operations	Preprocessing, coding, smoothing of inputs (Thompson, 1967)	Complexity of technical processes (Udy, 1959*b*; Woodward, 1965) Work-flow integration (Pugh et al., 1969) Routineness of work (Hage and Aiken, 1969) Automaticity of machinery (Amber and Amber, 1962) Interdependence of work units (Thompson, 1967; Lynch, 1974)	Control of outputs through stockpiling, rationing (Thompson, 1967) Value added in manufacture
Knowledge	Predictability (Dornbusch and Scott, 1975) Anticipation of fluctuations in supplies (Thompson, 1967)	Knowledge of cause-effect relations (Thompson, 1967) Analyzability of search processes (Perrow, 1970; Van de Ven and Delbecq, 1974) Information required to perform task compared with information possessed (Galbraith, 1973) Programmability (Sproull and Goodman, 1990)	Time span of definitive feedback (Lawrence and Lorsch, 1967) Forecasting of fluctuations in demand (Thompson, 1967)

organizations.[2] These three dimensions are complexity or diversity, uncertainty or unpredictability, and interdependence. We will discuss each briefly.

Complexity or diversity This dimension refers to the number of different items or elements that must be dealt with simultaneously by the organization. Specific measures such as multiplicity and customization of outputs and variety of inputs tap this dimension.

Uncertainty or unpredictability This dimension refers to the variability of the items or elements upon which work is performed or to the extent to which it is possible to predict their behavior in advance. Some of the general factors affecting the degree of uncertainty of the organization's task environment described in Chapter 6 are also relevant here. Specific measures of uncertainty include uniformity or variability of inputs, the number of exceptions encountered in the work process, and the number of major product changes experienced.

Interdependence This dimension refers to the extent to which the items or elements upon which work is performed or the work processes themselves are interrelated so that changes in the state of one element affect the state of the others. Thompson (1967: 54–55) has proposed a useful typology for assessing degree of interdependence. Three levels are identified: (1) *pooled* interdependence, in which the work performed is interrelated only in that each element or process contributes to the overall goal (for example, selecting fabrics and color schemes for the inside decor of a jet airplane is related to the plane's aerodynamic design only in that both contribute to the overall objective or final product); (2) *sequential* interdependence, which exists when some activities must be performed before others (for example, component parts of a jet engine must be produced before they all can be assembled into a single functioning unit); and (3) *reciprocal* interdependence, which is present to the degree that elements or activities relate to each other as both inputs and outputs (for example, design decisions regarding the weight and thrust of a jet engine and the aerodynamic design of the fuselage and wings must take each other into account). Thompson points out that these three levels of interdependence form a Guttman-type scale, in that elements or processes that are reciprocally interdependent also exhibit sequential and pooled interdependence, and processes that are sequentially interdependent also exhibit pooled interdependence.

As indicated, these dimensions are of interest because they can be employed to predict the structural features of organizations.

[2]The stage-of-processing distinction illustrated in Table 9–1 is also useful for predicting structural features since it indicates *where* in the technical core work-processing demands are likely to be heavier. Input units that must deal with a large amount of uncertainty will be structured differently than input units that handle only a small amount of uncertainty.

TECHNOLOGY AND STRUCTURE: RATIONAL SYSTEM VIEWS

Since matters can rapidly become complicated, we will state at the outset the major linkages that are expected to exist between an organization's technology and its structure. In noting these main effects, we recognize that the interaction effects—the effects produced by two or more of the variables in combination—are more powerful and frequently of greater interest. The predictions are as follows:

1. The greater the technical complexity, the greater the structural complexity. The structural response to technical diversity is organizational differentiation.
2. The greater the technical uncertainty, the less formalization and centralization.
3. The greater the technical interdependence, the more resources must be devoted to coordination. More specifically, Thompson (1967: 55–56) argues that pooled interdependence can be managed by *standardization*, the development of rules or routines; sequential interdependence requires the development of *plans* or *schedules*, which specify timing and order in the work processes; and reciprocal interdependence requires the use of *mutual adjustment* or coordination by feedback, in which the interrelated parties must communicate their own requirements and respond to the needs of each other. Each coordination strategy is increasingly costly in terms of resources.

Coordination Mechanisms

Galbraith (1973; 1977) has usefully argued that one way in which the varying demands of technologies on structures can be summarized is to ask how much information must be processed during the execution of a task sequence. He argues that information requirements increase as a function of increasing diversity, uncertainty, and interdependence of work flows. Using this simple formula to gauge information-processing demands, Galbraith then outlines a series of structural modifications organizations can make in their technical core as a means of adapting to increased demands for the processing of information. The following formal structures, discussed in order of increasing complexity, may be employed to manage the work flow.

Rules and programs Organizations performing the simplest and most routine tasks rely primarily on rules and performance programs to secure acceptable outcomes. And, of course, organizations carrying on even the most complex types of work perform many activities that can be regulated by rules and programs. These structural devices represent agreements about how decisions are to be made or work is to be processed that predate the work performance itself. Often rules and programs are embedded in the forms and documents that workers must complete—forms that specify what information is to be collected or what activities are to be completed. Such forms along with procedural manuals can be designed to accommodate considerable complexity and some uncertainty, particularly as re-

gards the sequence of events. For example, it is possible to develop rules for carrying out specific task activities and to add "switching rules" that signal which of several clusters of activities is to be performed or the order of their performance (see March and Simon, 1958: 142–50).

Schedules Schedules are necessary when different kinds of activities are to be carried on in the same location or when sequential interdependence is present. To information concerning the what and how of task performance, schedules add the dimension of when. Schedules also specify the period they are in force, and so are subject to modification. Galbraith suggests that increasing uncertainty can be handled by shortening the *plan-replan cycle*—that is, the period during which a given set of rules and schedules is in force.

Departmentalization One of the most difficult and critical of all decisions facing an organization is how work is to be divided: what tasks are to be assigned to what roles and what roles to what departments. As described in Chapter 2, early administrative theorists suggested that homogeneous activities be placed in the same organizational units, but critics noted that there are often several, competing bases for determining homogeneity (see March and Simon, 1958: 22–32). Thompson (1967: 57) has proposed that organizations will seek to group tasks according to their degree of interdependence, with reciprocally related tasks placed in the same or closely adjacent units, sequentially related tasks placed in less closely adjacent units, and tasks exhibiting pooled interdependence placed in the least closely adjacent units. Organizations are expected to behave in this manner because the type of coordination mechanism needed to cope with reciprocal tasks—mutual adjustment—is the most costly in terms of organizational resources; schedules, which are used to cope with sequential tasks, are the next most costly; and rules are the least costly. In short, Thompson argues that organizations attempt to group tasks so as to minimize coordination costs. It is instructive to note that Thompson's principle of minimizing coordination costs as an explanation for the location of departmental boundaries can be viewed as a special case of Williamson's (1975) principle of minimizing transactions costs as an explanation for the location of organizational boundaries[3] (see Chapter 7).

Hierarchy Hierarchy can be used to respond to increased information flows in two ways. First, as Fayol and other administrative theorists emphasized early in this century (see Chapter 2), officials can be used to

[3]Williamson's concept of transactions costs is broader than Thompson's concept of coordination costs because it includes the costs of negotiations between prospective exchange partners as well as the negotiations needed to cordinate exchanges once an agreement has been established. Within most organizations the former negotiations do not occur: one department is not allowed to determine whether or not to enter into exchanges with another unit in the same organization. However, in some very large organizations an attempt is made to simulate a market situation, and departments are allowed to decide whether to enter into exchange agreements with other internal units or to seek more favorable exchange rates externally. (See Chapter 10)

deal with unexpected or irregular occurrences on an "exception" basis. Of course, this practice can provide a satisfactory solution only if the exceptions do not arise too frequently. Second, as suggested by open system theorists (see Chapter 4), hierarchies can be used to group tasks (Simon, 1962). According to Thompson:

> It is unfortunate that [hierarchy] has come to stand almost exclusively for degrees of highness or lowness, for this tends to hide the basic significance of hierarchy for complex organizations. Each level is not simply higher than the one below, but is a more inclusive clustering, or combination of interdependent groups, to handle those aspects of coordination which are beyond the scope of any of its components. (1967: 59)

As the amount of interdependence among organizational tasks increases, it becomes more difficult to handle it by departmentalization—to contain, for example, all of the instances of reciprocal interdependence within an organizational unit. As interdependence overflows departmental units, a heavier burden of information processing is placed on hierarchical officers who are expected to provide links across units. For example, consider a manufacturing firm that begins to perform more customized work, fitting the product to the customer's particular requirements. We would expect the interdependence between the sales and the production departments to increase and to be reflected in higher levels of information to be processed during task performance: for example, specifications of desired products, information about cost and feasibility, and requirements for and predictions concerning delivery date. Under these circumstances, we would expect the sales and production units to be clustered under a common superior, who would facilitate the flow of information between the two as a means of coordinating their work.

Delegation Rather than attempting to program and regulate closely the work of all participants and requiring that all decisions be made above the level of the performers, organizations confronting increased complexity and uncertainty can delegate some autonomy to workers. Galbraith (1973) refers to this arrangement as *targeting* or *goal setting*, indicating that coordination is secured not by minute descriptions of work procedures but by specification of the desired outcomes. In the example of the manufacturing firm performing more customized work, a manager could provide the production department with a detailed specification of the desired product together with cost and time constraints but allow participants to exercise their own judgment and skills in arriving at a product that would satisfy these requirements. Delegation is present to some extent and for some positions in most organizations. However, it reaches its most highly developed form in professional organizations, a form to be discussed more fully later in this chapter.

Micro coordination An important coordination device, often overlooked, but used by many organizations is to rely on the capacity of the task object to monitor and guide the services it receives. Professional organizations such as universities and hospitals often recognize their task

objects to be subjects who can, to some extent, look out for their own interests. Students, for example, may be told that it is their responsibility to meet all graduation requirements. They are expected to call attention to any problems or defects in their treatment. And many manufacturing organizations, particularly those providing customized products to knowledgeable customers, have come to realize the value of recognizing these "external" groups as valuable interested participants. The extent to which clients and customers are capable of and permitted to exercise such micro-coordination varies greatly across organizations.

Reducing Information versus Increasing Capacity

Rules and programs, schedules, departmentalization, hierarchy, and some delegation: these are the ubiquitous features of complex formal organizations. By means of these conventional structural mechanisms, organizations are able to respond to task demands posing moderate information-processing requirements. But what if the levels of diversity, uncertainty, and interdependence are higher still so that conventional solutions prove inadequate? Galbraith argues that an organization confronting excessive levels of task complexity and uncertainty can choose one of two general responses: it may elect to (1) "reduce the amount of information that is processed," or (2) "increase its capacity to handle more information" (1973: 15). Although these two responses push in different directions, they are not necessarily incompatible. Moreover, each response may be made through one of several strategies, and an organization may pursue more than one strategy at the same time. Strategies designed to reduce information processing are described first.

Product versus process organization We have noted that information-processing costs can be reduced by placing highly interdependent tasks in the same or adjacent work units. This principle underlies the creation of product-based departments. For example, a publishing organization may begin with a departmental structure based on function or process criteria: editorial, production, and marketing divisions. Suppose that two product lines develop: college texts and trade (commercial bookstore) publications. At some point, the costs of attempting to handle the information that must accompany these quite different types of products across the three divisions may become sufficiently high that the company decides to reorganize on a product basis. Now we have two divisions: text and trade, each with its own departments of design, production, and marketing. The diversity of information processing required by the former structure has been substantially reduced by a shift from process to product organization.

The costs accompanying the use of product departments are primarily those associated with the loss of economies of scale. The scale of each unit has been reduced, and this may prevent the use of specialized personnel or machinery that can be supported only by a large volume of work. Product-based organization also reduces the likelihood that the benefits of variety—stimulation, transfer of learning, overlap of domains—will be available to enrich the organization or its participants.

Slack resources An organization can reduce its information-processing demands simply by reducing the required level of performance (see Galbraith, 1973). Higher performance standards increase the need for coordination: lowered standards create slack—unused resources—which provides some ease in the system. For example, if delivery deadlines are not set so as to challenge the production units, then the need for information processing is reduced. If there are few constraints on inventory levels, then rapid response to changes in supply and demand messages is less essential. And, to use a nonmanufacturing example, if every third-grade teacher uses the first several weeks to reteach the basic lessons and skills of the second grade, then the sequential interdependence between second- and third-grade teachers is reduced, and there is less need for coordination of their efforts.

In addition to storing extra components and introducing redundancy into task performances, an organization can store surplus task or workflow information. In his study of the complex structures that supply repair services for the electronic equipment required to support the U.S. Naval Air Systems Command, Kmetz (1984: 272) details the use of *information buffers*—"pools or collections of information formed to support decision making or monitoring of workflow variables." At critical junctures in the repair process, varying types of information—samples of data, knowledge of legitimate and unsanctioned routines, backup guides and records—develop as alternatives to or supports for the official communications and data packages. For example, "a relatively formalized buffer, such as a work-around notebook, supports repair of a WRA [weapon replaceable assembly] independently of the accuracy of the test program" (1984: 273). Such slack resources allow looser coupling of interdependent work systems.

Some slack in the handling of resources, including information, is not only inevitable but essential to smooth operations. All operations require a margin of error—an allowance for mistakes, waste, spoilage, and similar unavoidable accompaniments of work. The question is not whether there is to be slack but how much slack is to be permitted. Excessive slack resources increase costs for the organization that are likely to be passed on to the consumer. Since creating slack resources is a relatively easy and painless solution available to organizations, whether or not it is employed is likely to be determined by the amount of competition confronting the organization in its task environment.[4]

While Galbraith emphasizes that slack resources reduce information-processing requirements by lowering standards, it is equally important to emphasize that they reduce the need for information processing by reducing interdependence. Conventional organizational routines of mass and batch production assume pooled or, at most, sequential interdependence:

[4]March and colleagues have pointed out that organizational slack is also a critical resource supporting organizational experimentation and learning (Cyert and March, 1963; Levitt and March, 1988). March notes that search activities motivated by slack—rather than by immediate problem-solving pressures—are "less likely to solve immediate problems, more likely to be directed to subunit or individual objectives, and more likely to discover distinctively new alternatives" (1988: 4).

design engineers are departmentally buffered from production workers who, in turn, are separated from marketing personnel. Designs are "tossed over the wall" to production workers who have little say in the design but are expected to produce products for sales people who often have little say in what is being produced. The new innovations in production processes—CAD (computer-aided design), CAM (computer-aided manufacturing), JIT (just-in-time inventory controls)—do not simply entail the use of new computer technology but also involve significant structural changes as buffers between departments are reduced and interdependence increased (see Susman and Chase, 1986; Adler, 1990). Designers are expected to interact with manufacturing workers as they take into account the "producibility" of the product; and marketing personnel—who best know their customer's needs—are expected to exercise increased influence in both the design and production process (see Chase and Tansik, 1983). Interdependence escalates from pooled to sequential to reciprocal; and the information processing capacity of the organization must be enhanced.

The following strategies are intended to increase the information-processing capacity of the organization. We describe here only the more formalized strategies—those that rely on the explicit design of new roles and relations to process heightened information flows.

Augmented hierarchies Many analysts have observed that although hierarchies can assist the coordination of work by imposing patterns and constraints on the flow of information, if the messages sent become too numerous or the content too rich, a hierarchical system can quickly become overloaded (see Chapter 7; see also Rogers and Agarwala-Rogers, 1976; Kreps, 1986). The capacity of the hierarchical system can be increased in two ways. The first is to improve the methods by which information is gathered and transmitted to the decision-making centers. In earlier times, and at the present time for many functions, this is accomplished by adding specialized administrative and clerical personnel—inspectors, accountants, secretaries—charged with gathering and summarizing the information needed for decision making. More recently, some of these functions have been taken over by increasingly sophisticated electronic monitoring, transmission, and data-reduction systems. The design of systems that will permit the rapid transmission of relevant, "on-line" information through feedback loops to appropriate decision centers is one of the major aims and achievements of the modern systems-design movement (see Sprague and Watson, 1986; Zmud, 1983). Huber (1990) argues that the employment of advanced information technologies tends to increase the number of information sources but to reduce the number of intermediate human actors involved in its transmission.

The second method for increasing a hierarchical system's capacity to process information is to work not on the receptors or the transmitters but on the decision centers, the nodes of the system. One of the earliest and most widely used structural modifications of the simple hierarchy—the creation of the staff-line distinction—may be viewed as a means of increasing the information-processing and problem-solving capacity of the system without formally decentralizing or sacrificing the unity-of-command principle. Staff "experts" give technical assistance and specialized advice to the generalist managers who are empowered to make the final decision. However, we know from a large number of studies that although the staff-line distinction may preserve the appearance of a unified command system, much actual power passes from the hands of line officers to staff associates (see Dalton, 1959; Goldner, 1970). In addition to these staff-line arrangements, the modern executive is likely to be supported not only by technical specialists but also by a variety of "assistants," "assistants-to," and "associates" who perform stable or shifting duties but always act on behalf of and subject to the approval of their superiors (see Hamilton and Biggart, 1984: 15–54). All, however, contribute to the capacity of the system to process information.

The new information technologies affect not only the gathering and transmission of information but its use in decision making. Although more research is required, Huber (1990) suggests that such technologies tend to support the more rapid and accurate identification of problems and opportunities, increase the availability of relevant and timely information and, in this way, improve both the speed and quality of decision making.

Lateral connections Consider the following situation. An aircraft company has reorganized, grouping workers within divisions by product, and one of the divisions is responsible for the development and testing of new types of jet engines. The departments have been created on a functional basis: there is a department housing the scientists and engineers responsible for design, a production department composed of the mechanical engineers and technicians responsible for building prototype engines, and a department of scientists and engineers responsible for evaluating and testing the models. Clearly this situation involves high levels of task complexity, uncertainty, and interdependence and will require the exchange of large amounts of information as the work is carried on. In a normal hierarchical structure, the communications required to coordinate performance among departments would be expected to flow up the chain of command from workers through supervisors to departmental managers. The managers would be expected to exchange information among themselves and with the division manager, arrive at a common definition of how the work was to proceed, and then communicate detailed instructions back down the hierarchies within each department. Given the extent of interdependence and the amount of information to be processed, such a process would entail long delays and great inefficiencies.

In situations of such heavy information flow, the development of more direct, lateral connections across work groups and departments is an obvious response. That is, lateral connections allow information to flow more directly among participants in interdependent departments or work groups, rather than up and over through hierarchical channels. Although the opening of such channels may seem both simple and obvious, it represents an organizational revolution! Informal communications and arrangements among interdependent workers exist in virtually all organizations and undoubtedly often save them from floundering because of inadequacies of the vertical channels. But we are dealing here not with informal but formal

structures: we are discussing the official legitimation of connections among workers across departmental boundaries. To permit such developments is to undermine the hierarchical structure: department heads are no longer fully in control of, and so cannot be held fully accountable for, the behavior of their subordinates. This is why organizations—even organizations facing fairly high degrees of uncertainty and interdependence—are reluctant to develop formal lateral connections. But if they decide to do so, they may choose among several mechanisms (see Galbraith, 1973; 1977), including the following:

Liaison Roles Liaison roles are specialized positions or units created to facilitate interchange between two or more interdependent departments. The responsibilities of such integrating roles may include troubleshooting, conflict resolution, and anticipation of problems. These positions are similar to staff roles except that they relate to two or more managers rather than to one. Lawrence and Lorsch (1967) examine the functions of such positions in organizations and discuss the characteristics of those individuals who fill them successfully. Their work is discussed more fully in Chapter 10. Note that the creation of liaison roles makes for a more complex management structure but does not undermine the hierarchical principle.

Task Forces A task force is by definition a temporary group that is given a delimited problem to solve. The expectation is that the group will be dissolved once its work is completed. The task force may involve its members full or part-time. Participants are drawn from several departments, and frequently from several levels, and are selected not only because of their interest or ability with respect to the work of the task force but also because of their stature in their own departments. In the case of the jet engine division, a task force involving representatives from all three departments might be created to codify the technical terms and symbols used by members of that division. The strength of the task force is that it allows multiple representatives to interact intensively over a short period to achieve a specific objective. Status distinctions that hinder free interaction are typically suspended during the group's existence. That such distinctions are present but ignored contributes to the special atmosphere of a task force[5] (see Miles, 1964). Because the task force is defined as temporary, its existence is compatible with the maintenance of the hierarchy. Indeed, task forces may function as safety valves, reducing tensions and solving problems generated by the continuation of the hierarchy.

Project Teams Whereas task forces are temporary systems created to solve nonrecurring problems, project teams are groupings of personnel across departmental lines that carry on some portion of the regular work of the organization. In the jet engine example, a team comprising several

[5]A particularly interesting and dramatic example is provided by President Kennedy's creation of a task force—the Excom, composed of trusted advisers and associates—to make recommendations to him on the course of action to be pursued during the Cuban missile crisis of 1962. The best account of this group's structure and deliberations is provided by the president's brother, Robert Kennedy (1969).

members from each department could be built around the design and testing of a highly experimental prototype engine. Members would be released from their regular duties over an extended period in order to better contribute to this effort. The typical project team would have a leader or manager responsible for planning and coordinating the work of the team as long as it performed as a unit. Departmental officers would, in effect, delegate authority to the project manager to act on their behalf during the project but would see to it that their own personnel were being used and treated appropriately.

A complex and facinating instance of the use of project teams occurs in the investment banking industry, as analyzed by Eccles and Crane (1988) and briefly described in Chapter 7. Here, although the basic structure is functional in form—including investment banking, sales, trading, and research activities—the working out of a "deal" for a specific client requires the rapid, short-term mobilization of varying combinations of specialists—sometimes from more than one investment bank—working in close combination with related specialists in the customer firm. The resulting structures are "flexible, flat, complex, and rift with conflict" (p. 133). High differentiation results from the high degree of specialization; but integration of efforts is equally important and achieved through various mechanisms, including the delegation of considerable discretion and power to the lead banker (project manager) and the creation of special liaison roles termed "relationship managers" who are responsible for integrating the efforts of all specialists within a given firm who share a common customer.

Matrix Structures The hallmark of the matrix is its multiple command structure: vertical and lateral channels of information and authority operate simultaneously. The ancient and sacred principle of unity of command is set aside, and competing bases of authority are allowed to jointly govern the work flow. The vertical lines are typically those of functional departments that operate as "home bases" for all participants; the lateral lines represent project groups or geographical arenas where managers combine and coordinate the services of the functional specialists around particular projects or areas (see Davis and Lawrence, 1977; Hill and White, 1979). This type of structure is illustrated in Figure 9–1, which depicts the formal structure of the rocket division of a space agency.

The constituent units of matrix structures may be relatively permanent or shifting (Sayles, 1976). The permanent matrix structure is illustrated by the rocket division (Figure 9–1), the products and requirements of which are relatively stable. Examples of organizations employing a shifting matrix structure are those that must maintain a fairly stable set of specialists but allocate them across a changing mix of project teams. Examples are research organizations such as RAND and SRI that perform research under contract to clients whose interests vary greatly—from assessing an experimental health care system to designing an airport complex for a developing nation. An economist might be involved in both types of projects, but would play quite a different role in each. All participants are responsible both to their functional superior and their project leader.

The conflicts between function and product that exist in at least a latent form in most organizations are elevated by the matrix organization

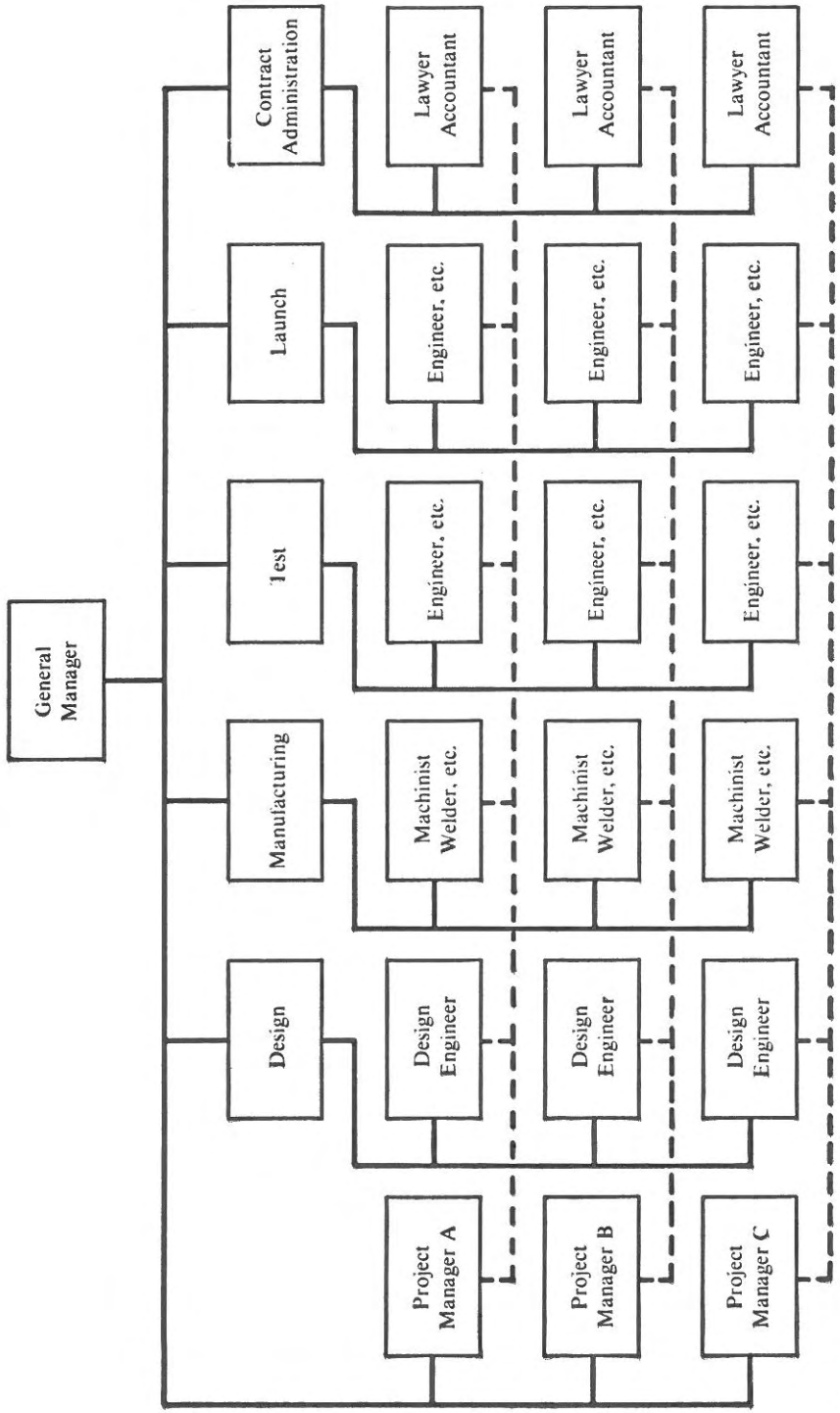

FIGURE 9–1
Matrix Structure: Rocket Division of a Space Agency. *Source:* Steiner and Ryan (1968).

into two competing structural principles. Although such institutionalization of conflict does not resolve it, it does ensure that both the functional and the product interests are viewed as legitimate and have managerial representatives who will continually define and defend them. Moreover, assigning specific roles the responsibility for defending particular values gives them higher visibility and makes trade-offs or compromises more evident: conflicts between decision makers are more visible than conflicts within a single decision maker.

Some of the overt interrole conflicts built into the matrix structure are managed by sequential attention to one or another set of priorities. In what has been called the *matrix swing*, functional priorities may receive more attention at the beginning and ending of a project cycle as personnel are hired or released and as budgets are negotiated, but once a project is under way, attention and authority swing to the project leader. Still, much ambiguity must be tolerated and competing claims accommodated for the matrix to function. For many participants, matrix structures are high-demand, high-stress work environments (see Davis and Lawrence, 1977; Larson and Gobeli, 1987).

Empirical Evidence

Empirical studies examining the relations between technology and structure have produced a body of evidence that is generally supportive of the predictions of contingency theory, but also suggests that the relations are relatively weak. (For reviews, see Gerwin, 1981; Fry, 1982; Scott, 1990b.) Many technical problems beset these studies, including problems in employing different types of measures, in ignoring or confusing levels of analysis, in failing to specify the expected form of the contingency relation, and in focusing on only a few selected relations rather than combinations or patterns of relations.

With respect to measures, we have already called attention to the wide variety of technology measures employed (see Table 9-1); and similar creativity has characterized the development of structural measures (see Van de Ven and Ferry, 1980). Clearly, these measures are not interchangeable: they assess different facets of technologies or structures. Also, different data sources are often employed including the judgments of officials acting as informants, the reports of rank-and-file participants, observations, and documents. Pennings (1973) has noted the low convergent validity of varying sources of information.

Some studies relating technology and structure are conducted at the level of the organization as a whole; others use the work group or department as the unit of study; still others examine the nature of individual tasks and associated work arrangements. Efforts to relate technical and structural measures at the organizational level are extremely hazardous because organizations tend to employ a variety of technologies and to be structurally complex. Some analysts have attempted to resolve the difficulty by what might be termed a "mix-master" method: data on technology and structure are gathered from various participants and work units and then combined to produce overall scores for the two subsystems. Thus, the Aston group (Hickson, Pugh, and Pheysey, 1969) aggregated data gathered by

interviews with chief executives and a number of department heads into a single measure, work-flow integration, to characterize the technology of the organization as a whole. And Hage and Aiken (1969), while careful to give greater weighting to the reports of the supervisory staff, combined worker and supervisor responses across departments to arrive at a single measure of routineness of work for each organization in a sample of health and welfare agencies. Similarly, structures that are likely to exhibit considerable diversity in centralization or in formalization, for example, are characterized by an average score reported for the organization.

Analysts studying technology and structure at the departmental level confront less severe, but similar, problems caused by technical and structural heterogeneity. Many work groups and most departments include different types of work, particularly in the case of product-based organizational structures. Further, studies (for example, Bell, 1967; Mohr, 1971) that measure the characteristics of tasks performed by individual workers and aggregate them to form measures of some modal task characteristics may not only cause the analyst to overlook variance across individual workers but fail to capture those characteristics of technology that are distinctive to the group level, such as work variety or complexity at the departmental level (see Comstock and Scott, 1977).

Even at the level of the individual worker we must be prepared to encounter multiple types of work and varied work structures (see Dornbusch and Scott, 1975). The range of tasks performed is likely to vary in complexity and uncertainty; and control structures often take such differences into account. For example, universities employ different arrangements to manage teaching than to oversee research.

In summary, given the great diversity and complexity of the types of work and the structures encompassed by most organizations, we should not be surprised to learn that many specific studies report varying and contradictory findings. When the subject of study is variable and complex, findings will be highly susceptible to differences in the variables and indicators employed, the sample drawn, the level of organization studied, and similar research decisions.

The choice of the level of organization at which to conduct a study is particularly critical because organizational levels often relate in a complementary fashion: that is, uncertainty may be relatively low at one level *because* it is high at another. Thus, it is quite possible for individual workers to be confronted by complex and uncertain tasks within a relatively simple administrative system—for example the work of physicians in a small group-practice clinic. Conversely, individual workers may carry out a few simple tasks as part of a technology that is highly complex when viewed at the departmental level, as is the case with workers on an assembly line (see Mohr, 1971). The level of complexity and uncertainty at two adjacent organizational levels may vary dramatically. Indeed, an important aspect of organizational design is to decide where to locate such demands.

Another factor that inhibits the strength of observed associations between technology and structure is that most contingency theorists are vague about the expected form of the relations (see Schoonhoven, 1981). Some of the most interesting and consistent findings are those reporting nonlinear associations. Woodward (1965), for example, observed that as the extent of technical complexity increased from low (batch processing) through medium (mass production) to high levels (process production), the span of control exhibited a curvilinear (inverted U-shaped) pattern, with narrow spans of control occurring at the two extremes. Although such curvilinear patterns have been widely reported for a number of measures of control (see Lincoln, Hanada, and McBride, 1986), most analysts continue to apply statistical tests that incorporate assumptions of linearity. Better specified theoretical and statistical models are needed if progress is to be made in understanding these relations.

Yet another limitation of current efforts to test contingency predictions is that most studies examine only one relation at at time—for example, the relation between uncertainty and formalization—although the theory implies that technologies and structures consist of multiple-variable, patterned relations. An interesting attempt to evaluate such a configurational framework is reported by Drazin and Ven de Ven (1985), who studied 629 employment security offices. They examined the relation between technology (task difficulty and variability), and 11 measures of structure (e.g., specialization, standardization) and process (e.g., mode of communication, methods of conflict resolution). The pattern of results supported contingency predictions: for example, high performing units under varying task conditions were observed to vary significantly in their structure/process characteristics from low performing units and to exhibit the predicted profile of structural and process characteristics.

The examination of the technology–structure relation has been extended during the past decade by a number of cross-cultural studies, many of which were motivated by an interest in determining whether contingency arguments are "culture-free".[6] Two sets of studies are of particular interest. The first, conducted by the Laboratory for the Economic and Sociological Study of Work in Aix-en-Provence, France, under the leadership of Maurice, examined the organization of work in nine factories, three each in Great Britain, France, and Germany, matched for technology using Woodward's categories of "mass production," "small batch," and "process" modes. Unlike the Aston group, these researchers emphasized more qualitative comparisons which recognize "that organizational features have to be seen as socially constructed in different ways, rather than measured along a standardized dimension" (Maurice, Sorge, and Warner, 1980: 72). They report relatively large and consistent differences by country in the organization of work. German firms, regardless of technological complexity, exhibited higher levels of worker expertise, flexibility, and autonomy; British firms were intermediate, while French firms concentrated expertise and decision-making in top managers and staff specialists. Maurice and colleagues interpret such differences as reflecting broad variations in the wider

[6]It is possible for contingency theory to accommodate cultural variables simply by treating such differences as another kind of contingency affecting organizational design. However, to do so carries us far from the rational-system model that assumes, far from being shaped, that technology itself is the shaper, operating to produce similar structures in varying cultures and social settings (see Lincoln, 1990).

societies in educational institutions and industrial relations practice (see Maurice, 1979; Rose, 1985).

The second set of studies, conducted by Lincoln and colleagues (Lincoln, Hanada and McBride, 1986; Lincoln and Kalleberg, 1990), contrasts a sample of 55 American and 51 Japanese manufacturing plants. This research reports differences between firms in the two countries, with Japan exhibiting less specialization and taller hierarchies than the United States regardless of technology, and also some differences in the effects of technology, with Japan exhibiting weaker relations between workflow rigidity and centralization measures.[7] The important conclusion is drawn that "the impact of technology on structuring is stronger among U.S. organizations" than Japanese organizations of the same type, suggesting that in the Japanese context "the design of the organization becomes detached to some degree from the technology process and more attuned to the needs of the human workforce" (Lincoln, Hanada, and McBride, 1986: 358, 362).

The mixed and, at best, weak empirical support for the contingency theory predictions coupled with the growing evidence that technology–structure relations are influenced by broader social context has stimulated important critiques and alternative theoretical formulations which modify and challenge rational system formulations.

TECHNOLOGY AND STRUCTURE: NATURAL SYSTEM VIEWS

Analysts embracing natural system assumptions are increasingly reevaluating and reformulating rational system arguments concerning technology and structure. These critiques can, somewhat crudely, be organized around three themes: (1) questioning the determinants of technology; (2) reexamining the relation between technology and structure; and (3) emphasizing the role of informal structure.

The Social Construction of Technology

A growing number of economic historians and sociologists have begun to recognize that the development of technologies does not represent a working out of some sort of inexorable logic of technical determinism or economic efficiency but, instead, some combination of what is technically possible and politically acceptable. In this view, technologies are, in good measure, socially constructed. As Noble argues:

> Because of its very concreteness, people tend to confront technology as an irreducible brute fact, a given, a first cause, rather than as hardened history, frozen fragments of human and social endeavor. . . . The process of technological development is essentially social, and thus there is always a large measure of indeterminancy, of freedom, within it. Beyond the very real constraints of energy and matter exists a realm in which human thoughts and actions remain decisive. (1984: xi)

[7]Two different kinds of cultural effects are distinguished: (1) variable *level* effects, for example, the assertion that Japanese organizations exhibit lower levels of specialization than their U.S. counterparts; and (2) variable *causal* effects, for example, the assertion that task complexity is associated with different degrees of centralization in Japan than in the United States (see Przeworski and Teune, 1970; Lammers and Hickson, 1979b).

In this view, technology is socially shaped, containing not only materialist but also social and ideological determinants. Thus, Davis and Taylor (1976: 380) argue that social choices are "contained within the technological design" itself, pointing out: "It is well known that of the many technological alternatives considered in any instance, technical systems planners put forth only one as a solution." Indeed, they argue that much of the consistency that has been observed in technology–structure relations reflects "the assumptions held by the designers of the technological systems about men and social systems" rather than any technological imperative (p. 412).

A number of the "new" social historians have attempted to examine how social and political factors have influenced which technologies are developed and adopted (see, e.g., Hounshell, 1984; Shaiken, 1985). Noble (1984), for example argues that numerical control (NC) approaches won out over record-playback approaches to the design of automatically controlled machine tools because they located control in the hands of programmers and managers rather than among machine operators on the shop floor and so better served a number of powerful interests including the U.S. Air Force, aerospace contractors, and the engineering community.

And, in a more general speculative historical review, Piore and Sabel (1984) suggest that the choice made by industrializing societies to replace generalized tools with specialized machinery was not dictated by economic necessity but by political interests. "Power in the market, not efficiency (in the sense of a uniquely appropriate application of technology), decided the contest" (p. 40).

It is typical of these new histories of technology to emphasize the unevenness and unexpectedness of change, the diversity of causes and connections. Sabel observes that "The fit between what needs to be done and how it can be done is seldom as tight as the determinists imagine" (1982: 5). An important concern of these histories is to uncover "roads not taken" (Noble 1984)—to document alternative technical solutions and/or organizational arrangements that were possible or were employed, but did not become dominant. Most of these accounts also emphasize the role played by organizational politics, by vested interests, and by institutional arrangements in shaping and selecting the technologies that succeeded.

In these views, then, technology is itself a socially constructed reality. Technology does not shape social structure, as in the crude contingency version; rather, social structure, at wider societal as well as narrower organizational levels, shapes technology.

The Loose Connection of Technology and Structure

In addition to challenging rational system conceptions of the nature of technology, natural system theorists assert that while the choice of technologies may constrain the design of structures, it does not determine them. Theorists such as Child (1972) insist that the state of technology and other environmental conditions pose only broad and general constraints on struc-

tural design. Contingency theorists place too much weight on external constraints and do not give sufficient attention to actors and their capacity for choice. This line of argument, labeled *strategic contingency* (see Chapter 5), emphasizes that a given set of circumstances can support many alternative adaptative responses, many alternative strategies. Accordingly, what is an effective structure for a given organization is shaped not only by its technology and task environment but by the strategy adopted. (We consider strategy in Chapters 10 and 11.)

Strategic contingency theorists also remind us that the division of labor and the differential contacts of participants with others inside and outside the organizations create divergent perspectives and interests as well as new sources of power that can be used to pursue these interests (Hickson et al., 1971). The recognition of multiple interests within organizations has led to the coalitional model of organizations: many organizations are in no sense unified actors but are instead shifting combinations of varying interest groups moving in and out of the organization and up and down in relative power. If a particular group has a corner on some valued resource, such as legal expertise or scientific creativity, and there is no readily available alternative, it is likely to acquire power *within* the organization. And one of the uses to which power is put is to shape the structure of the organization.[8] More powerful actors are likely to attempt to locate more discretion in the positions they occupy and to attempt to reduce that located in other positions. Such struggles are not confined to blue collar workers and supervisors or managers; and are equally likely among school teachers and principles, between physicians and hospital administrators.

A related change that characterizes much of the recent literature is an increased emphasis on subjective versus objective views of technology. While the early, influential work of Woodward, Perrow, and Thompson treated technology as objective—as the empirically measurable features of the work processes or state of knowledge—more recent theorists have stressed that differently situated actors often hold divergent views of technology. Thus, in our studies of authority systems, Dornbusch and I (1975) discovered considerable variance in how work was viewed by participants in different locations. We stressed the importance of task *conceptions*, noting, for example that managers were more apt to stress the routiness of the tasks they were evaluating, whereas workers emphasized the complexity and uncertainty of these same tasks.

Of course, when we shift from technology to technical system, the opportunity for social and political forces to operate is greatly enlarged. How complex and uncertain work is, is strongly influenced by the specific technical systems that are created; on how and the extent to which work is divided. Similarly, interdependence is not only a function of the technical processes per se, but the ways in which they are distributed among workers. Through differentiation, complex tasks can be divided, made simpler, and more interdependent. Alternatively, by emphasizing a craft approach or through professionalization, complex tasks can be constructed, delegated to individual performers, and interdependence reduced. Differentiation,

[8]A related use to which power is put is shaping the goals of the organization (see Chapter 11).

deskilling, and interdependence (simplifying evaluation, increasing the need for coordination) are more likely to occur when managers exercise power; craft expertise, professionalization, and skill-enhancement (rendering external control more difficult, justifying increasing autonomy) occur when performers exercise power. Such arguments are not limited to, but are clearly consistent with those developed by Marxist theorists, who point to the continuing struggle for discretion and control occurring in the work place (see Chapter 7).

The emphasis that strategic contingency theorists place on the flexibility of connections—loose coupling—between technology and structure and on the role of power in shaping these connections is echoed by analysts examining effects associated with the introduction of new information technologies. Zuboff (1988) argues that these technologies—variously combining microelectronics, computer systems, telecommunications—exhibit two critical characteristics: first, they enhance *automation*, carrying forward the logic of nineteenth century machine systems that "enables the same processes to be performed with more continuity and control." Second, however, the new technologies differ fundamentally from earlier machines because of their capacity to *informate* work processes by simultaneously generating:

> information about the underlying productive and administrative processes through which an organization accomplishes its work. It provides a deeper level of transparency to activities that had been either partially or completely opaque. (Zuboff, 1988: 9)

More specifically:

> The intelligence of the microprocessor that resides at the base of virtually every application not only applies instructions to equipment but can convert the current state of product or process into information. (Zuboff, 1985: 105)

Recalling Galbraith's insight that technologies affect structures by determining how much information must be processed during the task sequence, it is possible to see that some aspects of new technologies absorb information: such technologies as automation and robotics eliminate the need for the information-processing capacities of social structures. By contrast, other aspects of the new technologies generate or create new information: they are able to not only "apply programmed instructions to equipment but also convert the current state of equipment, product, or process into data" (Zuboff, 1988: 9). However, whether this new information is employed primarily to exercise greater control over the work process or provides the basis for increased innovation and autonomy among performers is not determined by the technology, but by choices made by those exercising influence in these work sites.

The general predictions of contingency theory as well as many of the newer insights of its critics—the social construction of technology, the loose connections between technology and structure, the emphasis on vested interests and power processes, the insistence that social structures are created and are subject to constant redefinition as actors carry out, variously and imperfectly, their work—are nicely combined in a study by Barley

(1986; 1990) of changes occurring in the social order of two radiology departments of hospitals at the time when computer tomography (CAT) scanners were introduced. Far from viewing it as determinant in its effects, Barley regards the introduction of the new technology as "an occasion" for restructuring of the technical system. "The scanners occasioned change because they became social objects whose meanings were defined by the context of their use" (Barley, 1986: 106) He documents how the interaction patterns exhibited by radiologists and technicians changed over time by isolating "scripts" that defined identifiable sequences in the changing order. Because of differences in the surrounding contexts, the varying expertise of personnel, and the specific course of interactions, identical technologies gave rise to different structural outcomes. Although "each department changed in similar directions, one department became far more decentralized" (p. 105).

Thus, the predictions of contingency theory receive support: the greater complexity and uncertainty of the new technology is associated with increasing decentralization. But so do those of the strategic contingency theorists who emphasize variable reactions and connections and stress the diversity of interests and the role of power.

Two final comments on the limitations of conventional contingency theory. First, it overemphasizes the role of intraorganizational forces. We have attempted throughout this discussion to stress the importance of wider social and institutional forces in shaping technology and technical–structural relations. Here we supply one additional example. The major incentive for many organizations to develop a project-management structure came not from within as a rational response to information processing demands but from outside the organization. The Department of Defense required its contractors to use this structural arrangement in the 1950s as a condition for obtaining financial support! (Wieland and Ullrich, 1976: 39). Government contract officers were tired of getting the runaround from functional department heads, each of whom had only partial control over any given project. The development of a project management format gave these officers someone they could more easily relate to and hold responsible for the successful and timely completion of the project. Second, contingency theory overlooks the importance of informal structures as a response to uncertainty and complexity.

Reliance on Informal Rather than Formal Structure

Contingency theory approaches to structural design, like all rational system models, stress the benefits of formalization. The rational system response to increasing task demands is to shorten and strengthen the leash: provide superiors with more and faster information so they can more rapidly change the instructions to performers; increase the ratio of superiors to performers so that more information can be processed more quickly and revised guidelines supplied to performers. Some of these modifications move in the direction of decentralization: power and authority are more widely dispersed as hierarchies are augmented and, particularly, as lateral connections are added. But formalization is, if anything, increased in these systems.[9] New types of roles are created and new linkages specified that increase the complexity, flexibility, and capacity for change in the structure. But the flexibility involved is designed, not spontaneous, and the changes reflect capacity to shift rapidly from one set of formal rules and roles to another.

We know, of course, that this central assumption is challenged by natural system theorists, who stress the advantages of informal structures, particularly as strategies for dealing with task uncertainty. These alternative approaches, which have received much recent attention, rely primarily on enlarged roles, internalized control, and informal structures to confront high levels of uncertainty and complexity. Rather than augmenting hierarchies, they minimize vertical distinctions, and rather than creating new, specialized lateral roles and relations, they encourage more direct, face-to-face communications among any or all participants as required. Decision making and the exercise of control become more decentralized, and organizational roles less formalized. We review several bodies of theory and research that emphasize the value of informal structures in work organization.

Socio-technical systems and work design We have briefly described the socio-technical system approach developed at the Tavistock Institute in London following World War II (see Chapter 5.) One of the guiding premises of this approach is that work involves a combination of social and technical requisites and that the object of design is to "jointly optimize" both components—not sacrifice one for the other. By contrast, rational system approaches are more likely to focus on the demands of the technical system, ignoring the psychological and social needs of workers. Technical systems are designed; then human workers are "fitted in" to their requirements. And to fit human behavior into a prespecified technical system requires that it be highly programmed, that the activities and interactions be specified and predictable—in a word, formalized.

If human as well as technical requirements are to be served, then it is necessary to determine what kinds of work situations motivate and satisfy workers. The Tavistock group emphasizes both individual task features as well as social organizational, particularly work-group, features. At the task level, repetitive, undemanding, isolated jobs undermine commitment and performance motivation. And at the work-group level, competition and close supervision forment stress, petty deceptions, scapegoating, and low morale. These effects were observed when more highly mechanized approaches were introduced in British coal mines—technical approaches that disrupted worker autonomy and work-group cohesion. (Trist and Bamforth, 1951) The solution was to restructure the situation so as to give more attention to its social components. In the restructured situation:

> Groups of men are responsible for the whole task, allocate themselves to shifts and to jobs within the shift, and are paid on a group bonus. Thus the problems of overspecialized work roles, segregation of tasks across shifts with consequent scapegoating and lack of group cohesion were overcome. (Pugh, Hickson, and Hinings, 1985: 86)

[9]The relation between formalization and decentralization is discussed in Chapter 10.

The rational system assumption that worker performance is enhanced when work demands are routinized and standardized—when complexity is factored into simple tasks and when uncertainty is removed—is strongly challenged by this approach. Organizations may thrive on certainty, but individuals do not! This counterassumption originating in the socio-technical school has given rise to a large body of theory and research pursued primarily at the social psychological level of the individual worker. The most influential of these are *job characteristics* theory and its elaboration in *work design and individual needs* approaches.

Briefly, research on job characteristics pursues the assumption that specific attributes of the job, such as variety, autonomy, and required interaction, are associated with worker motivation and work performance. Turner and Lawrence (1965) developed and tested these predictions by measuring the characteristics of forty-seven industrial jobs, but found the expected relations held only for workers in rural areas, who were presumed to have different needs or expectations for work than urban workers. Later research has pursued this "contingent" assumption that the relation between job characteristics and worker responses is mediated by worker expectations or needs (see Hackman and Oldman, 1980). The same types of job characteristics—variety, task identity, autonomy—are identified as important, as having "high motivating potential," but whether the potential is recognized depends on the psychological needs of the particular worker. Although a number of empirical tests of this more complex model of task characteristics and performance have been conducted (see, for example, Brief and Aldag, 1975; Stone, Mowday, and Porter, 1977; Steers and Spencer, 1977), the support is at best weak, and the research has been criticized on both methodological and theoretical grounds (see Roberts and Glick, 1981; Salancik and Pfeffer, 1977; Staw, 1984).[10]

The socio-technical approach has placed greater emphasis on the social organization of work groups—together with the necessary support features at higher organizational levels—than on the narrower matter of the design of individual jobs. Work groups, properly structured, can provide workers with an ongoing source of incentives, error correction, assistance, and social support that no amount of attention to individual job design can hope to match. The restructured semiautonomous work groups developed for the British coal mines suggests the type of approach deemed suitable to mechanized organizations with moderate levels of uncertainty and interdependence. A similar solution was developed by Volvo of Sweden when it decided to replace the traditional conveyor line for assembling its automobiles with movable automobile carriers that would permit more task variety and worker discretion embedded within a system empowering work groups as the central work elements (see Gyllenhammar, 1977). And Cole (1979) has described how, on the other side of the globe, Toyota Auto Body of Japan reorganized its work process to enrich worker skills, enlarge

[10]As might be expected, the concerns raised are similar to the problems already discussed involving the relation of technology to structure, including the issues of task conceptions (subjective versus objective views of task characteristics), direction of causation, and levels of analysis. For more detailed, critical reviews of this research, see Pfeffer (1982: 54-63) and Staw (1984).

worker discretion, and activate work-group incentives and controls in the now-famous "quality circles." These work groups are ordinarily organized around a particular type of job and are granted primary responsibility for such matters as safety and quality control. They become involved with "almost every other kind of problem, including improvement of productivity, the speed and way of stopping the conveyor belt, job procedures, job training, and human relations problems" (1979: 161).[11]

When the organizational environment becomes more turbulent and the work demands more uncertain, a socio-technical design suggests that redundancy of function is superior to redundancy of parts (Emery and Trist, 1965). Pugh, Hickson, and Hinings (1985: 89) summarize the critical difference between these two emphases:

> The traditional technocratic bureaucracy is based on *redundancy of parts*. The parts are broken down so that the ultimate elements are as simple as possible; thus an unskilled worker in a narrow job who is cheap to replace and who takes little time to train would be regarded as an ideal job design. But this approach also requires reliable control systems—often cumbersome and costly.
>
> An alternative design, based on the *redundancy of functions*, is appropriate to turbulent environments. In this approach individuals and units have wide repertoires of activities to cope with change, and they are self-regulating. For the individual they create roles rather than mere jobs; for the organization, they bring into being a *variety-increasing* system rather than the traditional control by variety reduction. . . . Autonomous working groups, collaboration rather than competition (between organizations as well as within them) and reduction of hierarchical emphasis, are some of the requirements for operating effectively in modern turbulence.

Organic Systems and Clans

During the early 1960s, Burns and Stalker studied a rather diverse group of about twenty industrial firms in Great Britain. Their sample included rather traditional textile companies, engineering firms, and a number of firms attempting to move into the rapidly growing market of electronics. Early in their field research, the investigators were struck by the presence of two quite distinct management styles—which they labeled the *mechanistic* and the *organic*. They noted that the two approaches tended to be associated with differing industries, or, more accurately, with differing types of industrial environments. The mechanistic firms were to be found in relatively stable environments, the organic in more rapidly changing environments. Burns and Stalker describe these two organizational systems as follows:

> In mechanistic systems the problems and tasks facing the concern as a whole are broken down into specialisms. Each individual pursues his task as something distinct from the real tasks of the concern as a whole, as if it were the subject of a subcontract. "Somebody at the top" is responsible for seeing to

[11]In a later study, Cole contrasts efforts to establish worker participation structures in Japan, Sweden, and the United States. They are more widely diffused in Japan than in Sweden and in Sweden than in the United States. His analysis shows that they are much more highly institutionalized in Japan and Sweden, receiving support from industry groups and the state (see Cole, 1989).

> its relevance. The technical methods, duties, and powers attached to each functional role are precisely designed. Interaction within management tends to be vertical . . .
>
> Organic systems are adapted to unstable conditions, when problems and requirements for action arise which cannot be broken down and distributed among specialist roles within a clearly defined hierarchy. Individuals have to perform their special tasks in the light of their knowledge of the tasks of the firm as a whole. Jobs lose much of their formal definition in terms of methods, duties and powers, which have to be redefined continually by interaction with others participating in a task. Interaction runs laterally as much as vertically. Communication between people of different ranks tends to resemble lateral consultation rather than vertical command. (1961: 5–6)

Organic systems, in response to conditions of high complexity and uncertainty, represent instances "where organization becomes an invertebrate process rather than a structure" (Grandori, 1987: 93).

More recent analyses have added to our understanding of this type of system. Ouchi (1980; 1981) defines it as a *clan* system. Building on the distinctions proposed by Williamson, he argues that just as hierarchies replace markets when transactions become moderately uncertain and complex, in a parallel fashion hierarchies fail and are replaced by clan systems when the transactions reach levels of extreme complexity and uncertainty.[12] Ouchi suggests that the costs of monitoring very complex exchanges by conventional or augmented authority systems is prohibitive and will increasingly give rise to "organizational failures" and the search for alternative structures. One viable alternative is the clan—a group that may or may not be linked by kinship ties but is based on common internalized goals and strong feelings of solidarity.[13]

Although clan systems are distinguished from formalized bureaucracies by a number of elements—including nonspecialized roles and career paths, implicit and internalized control mechanisms, holistic rather than segmented concerns, and slow and diffuse evaluation—Ouchi argues that their most important feature is the long-term, often lifetime, employment that they offer their participants. This characteristic was identified quite early as a distinctive feature of Japanese organizations (see Abegglen, 1958; Dore, 1973); Ouchi proposes it as a defining characteristic of all clan organizations—which include not only Japanese organizations but many others including some of the most "modern" and progressive U.S. firms, such as Hewlett-Packard, IBM, and Eastman Kodak (see Ouchi, 1981).

The expectation of long-term employment creates the conditions for a different type of control system. The employee sees his or her career prospects as being directly linked to the company's success. Conflicting

[12]Note that whereas the structural mechanism—informal, diffuse ties among participants—is one associated with the natural system perspective, the argument—reduction in transactions costs—is one stemming from the rational system perspective.

[13]Granovetter (1985) argues that Williamson greatly exaggerates the effectiveness of hierarchies in combating opportunism and underestimates the importance of informal, interpersonal controls in building trust and discouraging malfeasance. Thus, from this perspective, Ouchi's concept of clan is only a more highly developed instance of the control processes operating in all organizations.

interests are reduced and goal congruence enhanced (Grandori, 1987). And the long-term commitment provides both incentive and opportunity for the organization to "invest" in its employees, not only increasing their specific work skills and knowledge by providing extensive training and varied job experience but also developing their general understanding of organizational needs and programs and increasing their commitment to its goals and values. In short, we have the conditions for the development of elaborated internal labor markets (see Chapter 8).

These discussions that emphasize internalized controls and more diffuse, long-term attachments have been supplemented by analyses that stress the importance of creating and sharing a common corporate culture. Cultural symbols and meanings are held to be an important alternative to structural forms (see Deal and Kennedy, 1982; Peters and Waterman, 1982). We discuss and evaluate these arguments in Chapter 11.

PROFESSIONAL ORGANIZATIONS

Certainly the most elaborate and intricate organizational arrangements yet devised for coping with high orders of complexity and uncertainty in production systems are to be found in the *professional organization*. We began the discussion of technology and structure by stating three general principles relating characteristics of technology and of structure: greater technical complexity is associated with greater structural complexity, greater technical uncertainty is related to lower formalization and centralization, and greater interdependence is associated with more elaborate coordination structures. We now call attention to an important exception to the first principle. Technical complexity does not invariably give rise to greater complexity of structure; it may give rise instead to greater "complexity" of the performer. That is, one way to manage greater task complexity is not to divide the work and parcel it out among differentiated work groups or departments, but to confront the complexity with more highly qualified and flexible performers—with professionals. This response is particularly effective when (1) the work is also uncertain, a condition that militates against preplanning and subdivision, and (2) the work does not involve high levels of interdependence among workers. As an example of the latter, the teaching by faculty members in universities, the work of lawyers in law firms, and the work of physicians in clinics as customarily performed tend to involve relatively little interdependence. Whether complexity and uncertainty of work give rise to complex organizations or to complex performers is determined partly by the characteristics of the work itself but is also influenced by the political and social power of the performer group, as we have emphasized (see also, Larson, 1977; Abbott, 1988).

As complexity, uncertainty, and interdependence increase, professionals are more likely to move their work into organizational structures and take advantage of a more explicit division of labor and more formalized coordination mechanisms. Thus, complex performers enter into and are supported by complex organizational structures.

Professionals perform the core tasks of the organization under two general types of arrangements. The first, which I have labeled the *auton-*

omous professional organization, exists to the extent that "organizational officials delegate to the group of professional employees considerable responsibility for defining and implementing the goals, for setting performance standards, and for seeing to it that standards are maintained" (Scott, 1965*b*: 66). The professional performers organize themselves—as a "staff" in hospitals, as an "academic council" in universities—to assume these responsibilities. A fairly well demarcated boundary is established between those tasks for which the professional group assumes responsibility and those over which the administrative officials have jurisdiction. Even when professionals occupy the administrative positions, as is often the case, the boundaries tend to remain intact, so that the professional officials exercise authority over administrative procedures but are not granted direct control over professional tasks (see Goss, 1961). Rather, considerable discretion and autonomy are delegated to individual professionals, and they are subject only to collegial review and control systems, some formally mandated but others operating only informally. Examples of types of professional organizations likely to conform to the autonomous pattern include general hospitals, therapeutic psychiatric hospitals, medical clinics, elite colleges and universities, and scientific institutes oriented to basic research (see Stanton and Schwartz, 1954; Clark, 1963; Smigel, 1964; Freidson, 1975).

I have labeled the second type the *heteronomous* professional organization because in this arrangement "professional employees are clearly subordinated to an administrative framework," and the amount of autonomy granted them is relatively small (Scott, 1965*b*: 67). Employees in these settings are subject to administrative controls, and their discretion is clearly circumscribed. Unlike their autonomous counterparts, they are subject to routine supervision. This type of professional organization is exemplified by many public agencies—libraries, secondary schools, social welfare agencies—as well as some private organizations, such as small religious colleges, engineering companies, applied research firms, and public accounting firms (see Bidwell, 1965; Etzioni, 1969; Kornhauser, 1962; Montagna, 1968). Also, as Hall (1968) has pointed out, the distinction between autonomous and heteronomous structures can be applied to organizational departments as well as to entire organizations. Thus, the research and development department of a manufacturing company is likely to be organized as a heteronomous structure.

The structure of heteronomous professional organizations is in many respects similar to the arrangements already described in which organizations handle somewhat complex and uncertain tasks by *delegation*. The work of the professionals takes place within a structure of general rules and hierarchical supervision, but individual performers are given considerable discretion over task decisions, particularly those concerning means or techniques. Thus, individual teachers make choices regarding instructional techniques, and individual engineers make decisions concerning design or construction strategies.

Given that performers are expected to exercise more autonomy, we might expect to observe savings in supervisory costs: lower ratios of managers to performers or larger spans of control for supervisors. Several empirical studies, however, report just the opposite. In a study of 30 departments within a community hospital, Bell (1967) found that the greater

the complexity of work performed by department participants, the smaller the spans of supervisory control—the fewer workers a supervisor could manage. Similarly, in a study of 252 public personnel agencies, Blau, Heydebrand, and Stauffer (1966) found that the higher the qualifications of staff members, the higher the manager-worker ratio (see also Pugh, Hickson, and Hinings, 1969: 118–119). Blau and colleagues interpret these unexpected findings in terms that are now familiar to us: more managers are needed to handle the larger amount of information that must be communicated upward. Blau (1968) also points out that having more supervisors or managers reduces the centralization of decision making.

These analyses suggest that the more complex work carried on in heteronomous professional organizations is managed by both delegation and *augmentation of the hierarchy*. The hierarchy is augmented by the simple expedient of hiring more managers and reducing the span of control. Note, however, that the terms *manager* and *span of control* are misleading in this context, because the managers are themselves professionals and the proportional increase in their numbers signifies not increased closeness of supervision but an attempt to improve the transmission of information and the decision-making capacity of the organization.

The organization of autonomous professionals takes many forms, depending in particular on the degree of interdependence among the individual performers and performer groups. One of the primary strengths of the full-fledged professional is that he or she is deemed capable of independent decision making and performance, and this includes coordinating work with others as required by the situation. However, more explicit structural forms for coordinating work are required as professionals themselves become more highly specialized and are expected to coordinate not only their own work but the work of a growing number of paraprofessional workers, and as interdependence among work groups and departments increases. In many cases *project teams* are used. In hospitals such teams may be built around a particular type of surgical procedure—open-heart surgery is a dramatic example—or around the care of a particular group of patients—for example, children with cancer (see Fox, 1959; Beckhard, 1972). And faculty members in universities conduct an increasing amount of their research in project teams, each of which has a coordinator or leader, often designated the principal investigator. These arrangements support collaborative effort across disciplinary or departmental lines. *Matrix designs* are common in research organizations such as RAND (Smith, 1966) and are used in some hospital departments (Neuhauser, 1972). In many of these organizations professional participants and administrators exercise roughly equivalent power—an arrangement I have termed the *conjoint* professional organization (see Scott, 1982). Such arrangements attempt to combine the advantages of both professional and bureaucratic forms.

Organizations that in one way or another utilize lateral relationships as legitimate avenues of information and influence flows constitute the new generation of organizational forms. As we have attempted to illustrate, a number of different lateral structural arrangements are in use—including project teams, matrix structures, organic or clan systems, and professional organizations. All move us away from unitary hierarchical arrangements,

"beyond bureaucracy," or "from bureaucracy to adhocracy." Futurists and social commentators such as Bennis and Slater (1968), Bell (1973), Toffler (1970; 1980), Naisbitt (1982), and Davis (1987) agree that these new organizational forms offer new opportunities and challenges to participants but at the same time impose greater pressures and requirements on them.

SUMMARY

Most efforts to explain the structural complexity within the technical core of an organization focus on the characteristics of the work being performed—on the technology. A great many specific measures of technology have been proposed, some emphasizing different phases of the work process—inputs, throughputs, or outputs—and some focusing on different facets of the process—materials, operations, or knowledge. Most important for explaining differences in structural characteristics of organizations are three dimensions of technology: complexity, uncertainty, and interdependence. In general, we expect technical complexity to be associated with structural complexity or performer complexity (professionalization); technical uncertainty with lower formalization and decentralization of decision making; and interdependence with higher levels of coordination. Complexity, uncertainty, and interdependence are alike in at least one respect: each increases the amount of information that must be processed during the course of a task performance. Thus, as complexity, uncertainty, and interdependence increase, structural modifications need to be made that will either (1) reduce the need for information processing—for example, by lowering the level of interdependence or by lowering performance standards—or (2) increase the capacity of the information-processing system, by increasing the channel and node capacity of the hierarchy or by legitimating lateral connections among participants.

Empirical studies of the relation between technology and structure show mixed and often conflicting results. Among the factors contributing to this confusion are methodological problems, such as lack of consensus on measures or on measurement strategies, and theoretical problems, including misspecifications of the level of analysis at which the measures apply, disagreements among participants about the nature of the technology employed, and lack of clarity about the causal connections between technology and structure. Recent analysts have emphasized the extent to which social structures—both societal and organizational—shape technology, rather than vice versa.

Although significant attention has been devoted to the relation between technology and formal structures such as rules, schedules, hierarchies, and coordinating roles, much recent work emphasizes the importance of informal structures, particularly when high levels of uncertainty are confronted. Organic systems or clan structures are viewed as simultaneously fostering reliability and flexibility and as increasing worker motivation and commitment.

Professional organizations combine elements from both formal and informal approaches, stressing internalization of controls and worker autonomy and at the same time utilizing more formalized control systems such as project teams and matrix structures.

Chapter 10

Sources of Structural Complexity: The Peripheral Components

The device by which an organism maintains itself stationary at a fairly high level of orderliness . . . really consists in continually sucking orderliness from its environment.

Erwin Schrödinger (1945)

The division between the technical core and the peripheral components of an organization is admittedly somewhat arbitrary. It is intended to emphasize that organizations are composed of different units that respond to different forces. The previous chapter emphasized those portions of the organization—labeled the technical core—that carry on its primary work. We argued that the characteristics of the work performed are related to the characteristics of the structures created to contain the work. (Whether work characteristics produce structural characteristics or the reverse was discussed but not fully resolved.) Attention was limited to the characteristics of those structures that contain, control, or are otherwise close to the organization's central work flow.

In this chapter the focus broadens to include structures less directly tied to the technical core. They are peripheral in this sense and only in this sense: *peripheral* is not synonymous with *marginal*. The peripheral structures, for present purposes, encompass many aspects of the managerial and the institutional levels as defined by Parsons (see Chapter 3). We will examine, in particular, the structural changes at these levels that accompany the organization's attempt to buffer its technical core and construct bridges to other social units. These changes accompany the organization's efforts

to adapt to and modify its task environment. We also will examine structural features associated with the size of the organization. As we will learn, the meaning of size is far from clear, but its importance as a determinant of structural characteristics is well established. In the final section, relations between the core and peripheral structures are discussed.

A brief methodological note: Examinations of the structural features of organizations, their determinants, and their interrelationships require the collection of data from a large sample of organizations. In these studies, the organizations are themselves the units of analysis. Ideally, what is required is a large sample of organizations randomly drawn from a population of independent organizations.[1] The two major series of comparative studies to date—the research by Blau and his associates and the studies in England conducted by the Aston group—only partially meet these requirements, as will be discussed. Nevertheless, these pioneer projects constitute an important beginning to the systematic comparative study of organizational structure.

SIZE AND STRUCTURE

Defining and Measuring Size

What is size? Some analysts treat it as a dimension of organizational structure like formalization or centralization—one of several structural properties of an organization (see, for example, Hall and Tittle, 1966). Others treat size more as a contextual variable that measures the demand for an organization's services or products and thereby provides opportunities for and imposes constraints on its structure (see, for example, Blau and Schoenherr, 1971; Pugh et al., 1969). Like technology, size appears to be a variable that is on the interface between the organization and its environment: both variables are, on the one hand, internal features interacting with other structural properties and, on the other hand, features strongly shaped by external conditions. And, because it is externally driven like technology, size is more likely to be treated as an independent variable that shapes and determines other structural variables. If technology assesses what type of work is performed by the organization, size measures how much of that work the organization carries on—the scale on which the work is conducted.[2]

[1]Students of organizations have long discussed the value of studying a random sample of organizations within a society (see Freeman, 1986), but only recently has such a study been undertaken. Arne Kalleberg, David Knoke, and Peter Marsden are carrying out a study in which, as a first step, individuals drawn from a random sample of adults in the United States are asked who their principal employer is, and then, as a second step, data are gathered from informants regarding selected features in each of these organizations. This procedure results in a random sample of employment organizations, weighted by size of organization.

[2]Size can also be given an institutional interpretation. Size, particularly relative size, is closely associated with visibility and respectability. Larger organizations are more likely to be the targets of institutional actors (for example, state regulatory bodies) and are also more likely to provide the models imitated by other organizations.

As Kimberly (1976) notes, several different indicators of organizational size have been employed by researchers, each measuring a somewhat different aspect of size. Thus, some indicators, such as square footage of floor space in a factory or number of beds in a hospital, measure the physical capacity of an organization to perform work. Others, such as the sales volume or number of clients served during a given period, focus less on potential capacity and more on current scale of performance. And indicators such as net assets provide a measure of discretionary resources available to the organization.

Most studies of the relation between organizational size and structure have used the number of participants (usually employees) as an indicator of size. The advantages of this measure are that it tends to reflect both the capacity of the organization for performing work as well as the current scale of actual performance. Also, most of the dependent variables of interest—formalization, centralization, bureaucratization—are measures of methods for controlling and coordinating people, so that numbers of individuals are of more relevance than other possible indicators of size. However, using the number of participants as an indicator of size poses some problems. As previously discussed, it is often difficult to determine how to set the boundary between participants and nonparticipants. Also, comparisons of numbers of participants across different types of organizations can be misleading, since some types of organizations are much more labor-intensive than others.

We turn now to consider the major predicted and empirical relations between size and structure.

Size, Bureaucracy, and Differentiation

Early interest in the effects of size focused on its relation to the degree of bureaucratization, defined as the relative size of the administrative component of an organization. A number of critics—for example, Parkinson (1957)—have asserted that large organizations are overbureaucratized, devoting a disproportionate amount of their staff resouces to administration. Empirical investigations of the relation between organization size and bureaucratization conducted during the 1950s reported contradictory results: some researchers found that the administration was disproportionately large in larger organizations (for example, Terrien and Mills, 1955); some, that the proportion of administrators was smaller in large organizations (for example, Melman, 1951; Bendix, 1956); and some, that there was no association (for example, Baker and Davis, 1954). One important reason for the absence of any clear results is noted by Rushing (1966*b*). He points out that the administrative component of an organization is not a unitary structural element but rather, in his words, a "heterogeneous category" composed of varying participants performing quite different functional roles. Numerous studies have shown that if the administrative component is separated into its occupational categories—for example, managerial, professional and technical, and clerical—then these categories relate differently to size. In general, the proportion of managers tends to decline with increases in size, but the proportion of technical and clerical personnel is positively associated with size (see Rushing, 1966*b*: Blau and Schoenherr,

1971; Kasarda, 1974). The general point, however, is that the administrative component comprises various occupational groups that may relate differently to size.

A second basic reason for the absence of consistent associations between organizational size and administrative size is that size produces two different effects which have opposing consequences for the size of the administrative component. On the one hand, organizational size is positively associated with structural differentiation. Studies of a wide variety of organizations show reasonably consistent and positive associations between size of organization and various measures of structural differentiation, including number of occupational categories, number of hierarchical levels, and spatial dispersion of the organization—for example, the number of branch offices (see Blau, 1973; Blau and Schoenherr, 1971; Hall, Haas, and Johnson, 1967; Meyer, 1972; 1979*b*; and Pugh et al., 1969). Larger organizations tend to be structurally more complex. On the other hand, size is positively associated with the presence of more activities of the same general type. Size involves an increase in the *scale* of operations, which means not necessarily more kinds of operations (that is, differentiation) but more operations of the same kind.

As noted, these two effects of size have opposing consequences for the size of the administrative component. In a remarkable series of propositions, Blau (1970) attempts to summarize and resolve these conflicts, as follows. Large size is associated with structural differentiation, and differentiation, in turn, creates pressures to increased the size of the administrative component. This occurs because differentiation increases the heterogeneity of work among the various subunits and individuals, creating problems of coordination and integration. The administrative component expands to assume these responsibilities. On the other hand, organizational size is associated with increases in the average size of units, within which the work performed is relatively homogeneous. The larger the number of persons engaged in similar work, the smaller the number of administrative personnel needed to supervise them. In sum, larger organizational size, by increasing structural differentiation—that is, by increasing the number of different types of organizational subunits—increases the size of the administrative component, which must coordinate the work of these units; at the same time, larger organizational size, by increasing the volume of homogenous work within organizational subunits, reduces the size of the administrative component, which must supervise work within these units.

In their analysis of the fifty-three state employment security agencies, Blau and Schoenherr conclude that:

> Large size, by promoting differentiation, has the indirect effect of enlarging the managerial component, but the savings in managerial manpower resulting from a large scale of operations outweigh these indirect effects, so that the overall effect of large size is a reduction in the managerial component. (1971:91).

Such a conclusion may well hold for the type of organization studied, but may not necessarily be applicable to other types of organizations. Whether the administrative component is, on balance, affected positively or negatively by size would seem to depend primarily on what type of differentiation is involved. For example, differentiation that merely creates new units of the same type (segmentation) would be expected to have a less positive effect on the administrative component than functional differentiation which creates new types of units. And how much functional differentiation occurs would be determined primarily by the type of work the organization is performing—that is, by its technology—and by the type of environment—both technical and institutional—in which it is operating. We amplify these comments later in this chapter.

Size, Formalization, and Centralization

We have defined formalization as the extent to which roles and relationships are specified independently of the personal characteristics of the occupants of positions. Most empirical studies of formalization emphasize the extent to which rules such as formal job definitions and procedural specifications govern activities within the organizations. A Weberian model of structure would lead us to expect that the larger the size of the organization, the more formalized its structure would be, and indeed, most empirical studies support this prediction. Hall, Haas, and Johnson (1967) report only moderate but fairly consistent positive correlations between size and six indicators of formalization, including "concreteness" of positional descriptions and formalization of the authority structure. Blau and Schoenherr's (1971) study of state employment security agencies reports a positive association between organizational size and the extent of written personnel regulations in the state's civil service system.[3] And the Aston group (Pugh et al., 1969), in their study of forty-six work organizations, reports a strong positive correlation between size and scales measuring formalization and standardization of procedures for selection and advancement.

The conventional view of the bureaucratic model of organizational structure would also lead to the prediction that large organizations will have more highly centralized systems of decision making (see Hage, 1965). However, the studies by Blau and Schoenherr and the Aston group do not support this expectation. Rather, both research groups found that organization size was negatively correlated with several indicators of centralization. (For example, Blau and Schoenherr used measures of the decentralization of influence to division heads and the delegation of responsibility to local office managers, and Pugh and his colleagues developed scales for determining the level in the hierarchy where executive action could be taken subject only to pro forma review.) Consistent with the positive association between size and formalization, centralization was negatively associated with most of the measures of formalization. This pattern of results was also reported by Child (1972), who applied the scales developed by the Aston group to a national sample of eighty-two business organizations in Britain. And Mansfield (1973) reanalyzes these data to show that although the relationships are not very strong, the negative association between meas-

[3]Noting that this relation might better be tested at the state rather than the agency level, Blau and Schoenherr (1971: 58-59) also report a strong positive correlation between the total number of all state employees, as an indicator of the size of the state government, and the extent of formalized personnel regulations in the state's civil service system.

ures of centralization and standardization or formalization persist when the effects of size are controlled.

Blau and Schoenherr explain this unexpected pattern of results by suggesting that centralization and formalization may be viewed as alternative control mechanisms: more formalized arrangements permit more decentralized decision making. They argue that:

> Formalized standards that restrict the scope of discretion make decentralized decisions less precarious for effective management and coordination, which diminishes the reluctance of executives to delegate responsibilities way down the line to local managers far removed in space as well as in social distance from top management at the headquarters. (1971: 121)

Mansfield, perhaps with the aid of hindsight, scolds his colleagues for expecting a positive relation between formalization and centralization in the first place, arguing that Weber has been misread:

> It can be argued, paradoxically, that the only method by which the directorate in large organizations can retain overall control of the organization's functioning is by decentralizing much of the decision making within the framework of bureaucratic rules. It is reasonable to interpret Weber as implying a moderate negative relationship between the bureaucratic variables and the centralization of decision making. This proposition, however, runs counter to everyday notions of bureaucracy. (1973: 478)

Mansfield's interpretation of Weber's view is supported by our conclusion (in Chapter 2) that Weber's model of rational-legal authority provides a structure of roles that supports the exercise of relatively greater independence and discretion, within specified constraints, than are found in earlier administrative arrangements. The extent of bureaucratization and centralization is also affected by the organization's technology and the wider social and cultural environment in which it operates. We discuss these relations after briefly commenting on some problems in determining the effects of size on structure.

Problems in Relating Size and Structure

A number of problems attend studies of the relation between size and structure. Kimberly (1976) has addressed many of the more important issues. In addition to the fundamental question of the theoretical status of size—what does size measure?—the causal status of this variable is problematic. One reason we know little about the causal relation between size and structure is that virtually all of the studies conducted have relied on cross-sectional data. Several longitudinal studies suggest that inferences based on cross-sectional studies of organizations regarding the effects of organizational growth or decline on structure may prove to be misleading.

Holdaway and Blowers (1971), using data from 41 urban school systems in western Canada, report that when the data are examined cross-sectionally, the relation between organization size and administrative ratio exhibits the expected negative relation, but when they are viewed longitudinally, administrative ratios do not decline as a function of increasing

size in most of the districts examined over a five-year period. And a study by Freeman and Hannan (1975) based on data from 769 California school districts suggests that different relations obtain between size of organization and the administrative component, depending on whether the organization is in a period of growth or decline. Their analysis reveals that the size of the administrative component increases along with the size of the organization during periods of growth, but that during periods of decline the size of the administration does not decrease at the same rate as the rest of the organization. This disparity in rates leads Freeman and Hannan to be skeptical about attempts to develop generalizations relating organization size and administration from cross-sectional studies, since these studies will inevitably combine data from both growing and declining organizations.

Meyer (1979*b*) examined changes in the structure of 240 finance agencies located within the public bureaucracy of larger urban communities (greater than 50,000 residents), larger counties (greater than 100,000 residents), and the 50 states. Some data on change were collected as part of a panel study, with surveys being conducted in 1966 and again in 1972, but other change measures involved reports by agency officials describing when specified events occurred. Although Meyer's findings are complex and not easily summarized, they underline the importance of time of founding on structure: agencies established prior to 1900 exhibited lower levels of formalization than those founded between 1900 and 1939, and the latter class of agencies was less formalized than those founded after 1940. Unlike the previous studies reported, Meyer found no association between formalization and decentralization, but he did find positive correlations between formalization and number of levels in the hierarchy and between levels and decentralization. Meyer (1979*b*: 179) suggests that his longitudinal data support the conclusion that "hierarchy follows from extensive personnel procedures [formalization] and decentralized decision making from hierarchical differentiation."

Even these few studies make it clear that our present understanding of the interrelations among various structural characteristics of organizations is likely to be improved if not entirely transformed by the inclusion of longitudinal and historical data and analyses.

TECHNOLOGY, SIZE, AND STRUCTURE

Worker Competence and Structure

In Chapter 9, we discussed the relation between the qualifications of workers and the structural features of the technical core. We noted that employing personnel with greater expertise, such as craft workers or professionals, also affected the characteristics of more remote administrative structures. Hall's study (1968) of varying occupational groups in 27 organizations provides more complete information on the relation between worker competence and organizational structure. Hall assessed six structural features of these organizations: hierarchy of authority (defined as the extent to which the locus of decision making is prestructured); the division of labor (extent of functional specialization); presence of rules; extent of

procedural specification; impersonality (degree of formalization); and technical competence (extent to which universalistic standards such as qualifications and education are used in selection and promotion). Reasonably strong, positive correlations were found among all of these dimensions with the exception of technical competence. This variable was negatively correlated with all of the other structural attributes! The more highly qualified workers were found in those organizations that exhibited fewer "bureaucratic" attributes, as Weber defined the term: that is, those organizations with lower levels of task specialization, formalization, and standardization.

These results suggest that whether work is simplified and divided among less highly skilled participants or assigned to workers with higher skills who are granted more autonomy of action has implications not only for the immediate structure of the technical core but for the more remote general structural characteristics of organizations.

An apparent exception to our expectation that less extensive task subdivision and higher worker qualifications will be associated with greater decentralization of decision making is reported by Lincoln, Hanada and McBride (1986). In their study of U.S. and Japanese manufacturing plants exhibiting similar ranges of technological complexity (as described in Chapter 9), these researchers found, as expected, Japanese plants to exhibit lower levels of job specialization: Japanese workers were more likely to be generalists, performing a range of job functions. But contrary to expectations, centralization of formal decision making in Japanese firms was found to be higher than in U.S. firms. Further study, however, revealed that de facto or informal decision making was more decentralized in Japanese than in the U.S. plants. Lincoln and colleagues conclude: "the Japanese organizations delegate less formal authority than the U.S. plants, but in practice they permit greater involvement in decisions by employees lower in the hierarchy" (p. 353). The de facto structuring of decision making in Japan is consistent with the general expectation that more highly skilled workers are more likely to be found in more decentralized organizational structure.

It appears that one of the great watersheds in the design of organizations is the decision concerning whether tasks are divided and hierarchically coordinated or left in larger clusters and delegated to more highly skilled workers. Both represent instances of rational organization, but each is associated with a different structural form.

Technology versus Size

With two externally driven factors affecting the structural characteristics of organizations, the question naturally arises as to which is the more powerful. Both Blau and his colleagues and the Aston group argue for the overriding importance of size. Thus, early in the presentation of their findings on the employment security agencies, Blau and Schoenherr summarize the conclusion to which their data point: "Size is the most important condition affecting the structure of organizations" (1971: 57). It is difficult to accept this sweeping generalization because of the design of this and other studies carried out in Blau's program of comparative studies. In each

of several studies—of employment security agencies, public finance departments, colleges and universities, industrial firms—a single type of organization was selected for study. This has the effect of not allowing technology to vary meaningfully across organizations, since organizations of the same type all perform basically the same tasks or functions, while permitting size to vary freely, since both large and small organizations of the same type were included within the sample. Focusing on a single type of organization also reduces variation in other important environmental factors, such as the organization's political and economic context. (The effects of these enviromental factors on organizational structure are examined in the following section.) It is not appropriate to make comparative assertions as to the relative power of classes of variables under circumstances in which certain of them—in this case, technology and environment—are arbitrarily restricted in variation or excluded from consideration (see Beyer and Trice, 1979).

The studies conducted by the Aston group seem better designed in this respect (Pugh et al., 1963; 1968; 1969; Pugh and Hickson, 1976). Concerned with the limitations of focusing on one or a few selected variables, they defined and measured a large number of structural and contextual variables. These measures were then applied to a heterogeneous, random sample of 46 organizations in the Birmingham area in the original study and to a similar national sample of 82 British organizations in Child's (1972) replication. However, the Aston studies are difficult to interpret and, in particular, to compare with other studies because of the way in which the measures of structure and technology were treated. After carefully developing complex scales and subscales for measuring a number of widely recognized structural dimensions, including specialization, standardization, formalization, centralization, and configuration (the shape of the hierarchy), the anlaysts examined the interrelations of all of the scales. Rather than retaining the original theoretically based dimensions, they performed a factor analysis to determine what scales were sufficiently highly correlated to suggest the presence of a common underlying dimension or factor. Three major factors emerged from this empirical procedure: the first, *structuring of activities*, emphasized the covariation of those scales measuring specialization, standardization, and formalization; the second, *concentration of authority* emphasized measures of centralization; and the third, *line control of work flow*, emphasized control over work by line officials rather than by impersonal mechanisms. The factor analysis used was such that the resulting factors are orthogonal—relatively independent of one another. These factors were then related to such "contextual" variables as size and technology. And, as noted in Chapter 9, technology itself was measured by a complex series of scales combined to measure what the analysts termed *work-flow integration*.

As reported, size was found to exhibit strong and positive associations with the factor structuring of activities but was not correlated with the other two factors (Pugh et al., 1969). Technology, as measured by work-flow integration, showed "modest but distinct" correlations with all three factors, positive with structuring of activities and line control of work-flow, negative with concentration of authority. But after a more detailed analysis of these

data, including multiple correlations in which technology was combined with other variables, Hickson, Pugh, and Pheysey concluded:

> Operations technology as defined here is accounting for but a small proportion of the total variance in structural features. Other variables contribute more. On this sample, the broad "technological imperative" hypothesis that operations technology is of primary importance to structure is not supported. . . . The present data suggest that operations technology has only a limited specific effect compared with size.[4] (1969: 388-89)

Although the Aston group's design appears better suited to comparing the relative effects of size and technology, a number of problems reduce confidence in their conclusions. The use of factor scores disrupts the connection between theoretically defined variables and empirical measures, so that it is often difficult to interpret measures of relations. Also, the measure of technology, work-flow integration, seems both to be narrow and to combine measures of work and work-flow inappropriately across levels, so that it also is difficult to interpret or accept. In addition, there are problems with the samples developed. The first sample was drawn exclusively from the Birmingham area and so can hardly be regarded as a representative sample of independent—that is, unrelated—organizations.[5] Further, as Child (1972) has noted, the sample contained a large number of branches, in contrast with independent companies, and this may have resulted in an inflated score for centralization and affected the observed relation between structuring of activities and centralization. The second sample used in the replication study was drawn from a broader sampling frame—all of Great Britain—but was restricted by type to business organizations. It seems clear that if investigators hope to conduct convincing studies of the relative impact of varying factors on the structural features of organizations, more care and attention must be devoted to adequacy of measurement and to sample design (see McKelvey and Aldrich, 1983; Freeman, 1986).

Finally, the problems with this research are not only methodological but theoretical. Aldrich (1972) has shown that the specific empirical findings reported by the Aston group may be used to support quite varying

[4]Hickson and his colleagues intend this generalization to apply only to the relation between technology and peripheral organizational structure. They did find associations between technology and some aspects of the technical core structures and suggest that the pervasiveness of these effects is a function of organizational size. They argue that:

> Structural variables will be associated with operations technology only where they are centered on the workflow. The smaller the organization the more its structure will be pervaded by such technological effects: the larger the organization, the more these effects will be confined to variables such as job-counts of employees on activities linked with the workflow itself, and will not be detectable in variables of the more remote administrative and hierarchical structure (Hickson, Pugh, and Pheysey, 1969: 394-95)

[5]The same criticism can be made of Woodward's (1965) sample of industrial firms, all of which were drawn from the same region of South Essex, and of Hage and Aiken's (1969) sample of sixteen health and welfare organizations, all of which were located in the same metropolitan area. Thus, each of these studies was limited to a sample of organizations within the same areal field.

interpretations of the relations among size, technology, and structure. The correlational data are consistent with models in which technology is presumed to influence structure directly as well as indirectly through size as well as with models in which size is assumed to have causal priority. Therefore, empirical results from cross-sectional studies alone cannot resolve the issue of the relative importance of size and technology as determinants of organization structure.

ENVIRONMENT AND STRUCTURE

Buffering, Bridging, and Structural Complexity

Chapter 8 described some of the specific mechanisms used by organizations to buffer their technical cores from disturbing environmental influences and to build bridges to essential exchange partners and allies. Such organizational responses to the technical environment are not a simple matter of utilizing selected techniques or mechanisms. Associated with their use are fundamental changes in the structure of the organization.

Mapping environmental complexity What changes may be expected when organizations employ one or more of the several buffering techniques we have described: coding, stockpiling, leveling, or forecasting? Such activities will require the development or recruitment of personnel with new and different skills from those employed in the technical core itself. These participants require additional space and special equipment. In short, as the need for such buffering techniques grows, we expect to observe the development and growth of new specialized staff roles and departments at either end of the technical core—in other words, buffering units that interface with the input and output environments of the organization.

Consider also the use of the simpler bridging techniques, such as bargaining, contracting, and co-optation. As the task environment becomes more differentiated and active with the development of segmented labor markets, rapid technical and scientific developments, multiple types of buyers and sellers, subcontractors to oversee, and competitors to watch and attempt to outmaneuver, the organization responds by adding new types of occupational groups and specialists to deal with each of these environmental sectors. Organizations hire personnel officers and labor relations experts to deal with more complex labor markets; scientists, engineers, research administrators, and patent lawyers to participate in and keep pace with scientific developments; purchasing agents and marketing specialists to relate to the input and output environments; contract specialists and auditors to negotiate with and police contractors, market analysts, and sometimes even industrial spies to look after competitors. Most of these additions to the organizational structure involve the creation of new staff or support departments attached to the managerial level of the organization.

Structural elaboration may also occur at the institutional level as the size of boards of directors is increased to allow for the addition of new types of board members, who will connect the organization with sectors or

units of importance in their environment. Or it may occur as advisory structures are created to broaden the linkage of the organization to its task environment. Thus, the increasing complexity of the task enviroment is adapted to by increased structural complexity—differentiation—on the part of the organization.

This adaptation occurs not only in response to technical environments but also as a reaction to institutional environments. Organizations enhance their chances for survival and resource acquisition by adhering closely to the institutionally defined patterns, by incorporating them in their own structures, by becoming structurally isomorphic with them (Meyer and Rowan, 1977; DiMaggio and Powell, 1983).

Where—in what part of the organizational structure—the external complexity is mapped can vary. Public schools in more complex funding and regulatory enviroments become more administratively complex, but much of this reaction occurs at the level of the district office rather than in the structure of the individual school (see Meyer, Scott and Strang, 1987; Scott and Meyer, 1988). Similarly, individual hospitals respond differently to the constraints of their regulatory environments than do hospitals belonging to multi-hospital systems (Fennell and Alexander, 1987).

As might be expected, organizations are very sensitive to the nuances of the normative climate in their institutional environments: they take account of the amount of support for and conflict over particular reforms and proposed changes. Rowan (1982) has examined changes in the staffing of a sample of California school districts between 1930 and 1970. He reports that the hiring of district specialists in the areas of health, psychology, and curricular matters was highly responsive to the level of support and attention to these domains that was reflected in broader educational movements and national and state political acts. The higher the consensus—or in Rowan's words, the more "balanced" the institutional environment—the more widely diffused were officials identified with these movements; the more unbalanced the domain, the more irregular were the patterns traced by the districts in hiring and retaining appropriate specialists.

Whether differentiation of organizational structure occurs as a rational system response designed to support the buffering and bridging activities of organizations attempting to regulate critical resource flows, or as a natural system response designed to coalign the structure with its institutional environment to ensure its survival, the more general processes at work here are best depicted by the open systems perspective. This approach insists that an organization, as an open system, adapts to more complex environments by itself becoming more complex: it is a type of system "whose persistence and elaboration to higher levels depend upon a successful mapping of some of the environmental variety and constraints into its own organization on at least a semipermanent basis" (Buckley, 1967: 63).

It is important to stress that the organization's "mapping," or incorporating, of portions of the "environmental variety" into its own structure introduces new and different, and sometimes alien and hostile, elements into its own system. For example, the hiring of a labor relations specialist by a personnel department presumably introduces a person with expertise in, and experience with, labor unions. Such persons are hired because of

their ability to understand, communicate, and negotiate with unions and their representatives. They may be more similar in background and training and attitudes to their counterparts in the unions than to their colleagues in the personnel department (see Goldner, 1970). The same is true for hundreds of other types of occupational groups whose services are required by the organization but whose value depends on their marginality to the system and on their connections with similar groups in other organizations.These associations among persons in similar occupational groups—accountants, computer specialists, labor lawyers, public relations experts, advertising managers—across different organizations are among the most important bridges linking contemporary organizations. The flow of individuals back and forth across these bridges sometimes creates problems for the larger society (see Chapter 12) but always creates problems for the host organization, which must attempt to control and integrate their activities and resolve their conflicts.

Conflict, integration, and loose coupling The study by Lawrence and Lorsch (1967) of plastics manufacturing companies, which has been referred to several times in this volume, illustrates many of the major points we wish to emphasize.[6] As will be recalled (see Chapter 4), their research showed that (1) the task environments confronting the plastics manufacturing companies were highly varied, differing for research, production, and marketing functions; (2) this environmental variety was mapped into the structure of the organization, resulting in the creation of separate departments to confront these diverse environments; (3) however, the more differentiated the departments within each organization, the more likely were disagreements and conflicts to develop and the more difficult the problems of coordinating and integrating their work; and (4) therefore, the more differentiated the departments *and* the more successful the organization in integrating their efforts, the more effective the organization.[7]

The primary integrating mechanism used in the plastics companies studied was that of liaison roles: special roles were created to help to integrate the work of the three basic departments and resolve conflicts among them. Lawrence and Lorsch (1967: 54-83) report that the more successful integrators possessed attributes and orientations intermediate to those of the units they bridged, exercised influence based on technical competence, were oriented to the performance of the system as a whole, and enjoyed high influence throughout the organization. Walton and his colleagues (Walton, Dutton, and Fitch, 1966; Walton and Dutton, 1969) have also studied interdepartmental conflict in organizations and strategies for re-

[6]The results of interest in the present context are based on a study by Lawrence and Lorsch of only six plastics companies. Since the organizations themselves were the units of analysis, this is a very small sample on which to base any firm conclusions. We prefer to treat their research as a stimulating exploratory study valuable chiefly for the ideas generated, not for the hypotheses confirmed.

[7]To arrive at a composite rating of effectiveness Lawrence and Lorsch (1967: 40) combined objective measures of change in profits, sales volume, and number of new products with subjective ratings by managers of how well their companies were performing. We will examine these and other measures of effectiveness in Chapter 13.

solving it. They note that such conflicts often develop out of mutual task dependence, task-related asymmetries, conflicting performance criteria, dependence on common resources, communication obstacles, and ambiguity of goals as well as organizational differentiation. Such conflicts can be met with varying responses, from structural redesign to third-party consultation and attempts at reeducation of participants (see Blake, Shephard, and Mouton, 1964; Likert and Likert, 1976; Rahim, 1986).

Note however, that it is a rational system perspective that underlies most of these concerns with the integration of structurally differentiated departments. It is assumed that the organization is primarily a production system and that when conflicts occur among subunits, they must be resolved. Conflict interferes with goal attainment, and its resolution is associated with greater effectiveness of performance. A quite different view of conflict and conflict resolution processes is associated with the natural system perspective, which presumes that interdepartmental conflict is not primarily a product of error, ambiguity, and ignorance but results from quite fundamental divergences in group interests, and that the struggles are concerned not simply with means but with the goals to be served by the organization. These matters will be discussed in Chapter 11.

The assumption that integration is required because differentiation is present is also consistent with the rational system assumption that the various parts of the organization should be tightly coupled, each harnessed in the service of unified objectives. By contrast, the open systems model of organizations envisages a system of more or less loosely coupled elements, each capable of autonomous action (see Chapter 4). Weick (1976) and Orton and Weick (1990) note a number of ways in which loose coupling of these structural elements may be highly adaptive for the organization, particularly when it confronts a diverse, segmented environment. To the extent that department units are free to vary independently, they may provide a more sensitive mechanism for detecting environmental variation. Loose coupling also encourages opportunistic adaptation to local circumstances, and it allows simultaneous adaptation to conflicting demands. Should problems develop with one department, it can be more easily sealed off or severed from the rest of the system. Moreover, adjustment by individual departments to environmental perturbation allows the rest of the system to function with greater stability. Finally, allowing local units to adapt to local conditions without requiring changes in the larger system reduces coordination costs for the system as a whole.

Obviously some organizations effect tighter coupling among their department than others, and within a given organization we will see variation in the degree of coupling. In general, we would expect to observe tighter coupling between units within a technical core linked by serial or reciprocal interdependence than between core units and those operating on the boundaries. Nevertheless, two words of caution merit emphasis. First, the extent of the interdependence, coordination, or coupling between any two organizational subunits is a matter for empirical determination, not assumption. Second, whether looser or tigher coordination or coupling is adaptative for the organization depends on the specific circumstances confronted.

From unitary to multi-divisional structures Before concluding our discussion of the structural consequences of buffering and bridging strategies, we need to consider the effects of large changes in the scale of the organization such as those associated with merger or divestitures. Based on results reported in the previous section, we would expect increased size to be associated with increased structural differentiation. But we can be more specific than this. Chandler (1962; 1977) and Williamson (1975; 1985) argue that when firms grow beyond a certain point, not just further differentiation but a structural reorganization is likely to take place. This shift is described as a change from a unitary to a multi-divisional structure. The *unitary* structure is the conventional organizational form composed of a management unit and several functionally organized departments. The *multi-divisional* structure is depicted in Figure 10–1. It consists of a general corporate office and several product-based or regional divisions, each of which contains functionally differentiated departments. These departmental units are subdivided into work units (establishments) that are distributed on a geographical or product basis.

In his classic account of the history of American business enterprise, Chandler (1962) points out that the multi-divisional form first appeared in this country shortly after World War I, and that it apparently was independently developed at about the same time by a number of major companies, including du Pont, General Motors, Standard Oil of New Jersey, and Sears, Roebuck. Chandler's arguments are complex and varied, but in brief, he identifies four phases of growth for American industrial enterprise. The first period, just after the Civil War, was a time of rapid expansion and resource accumulation. This was the age of the larger-than-life entrepreneurs who expanded their organizations, most often through vertical integration. In the second phase, a new generation of professional managers, differentiated from the owners or the founding entrepreneurs, developed "methods for managing rationally the larger agglomerations of men, money, and materials" (1962: 388). Attention was concentrated on the reduction of unit costs and the coordination of diverse functional activities. The first two phases are best represented in the United States by the development of the railroads. Chandler points out that:

> The safe, reliable movement of goods and passengers, as well as the continuing maintenance and repair of locomotives, rolling stock, and track, roadbed, stations, roundhouses, and other equipment, required the creation of a sizable administrative organization. It meant the employment of a set of managers to supervise these functional activities over an extensive geographical area; and the appointment of an administrative command of middle and top executives to monitor, evaluate, and coordinate the work of the managers, responsible for the day-to-day operations. It meant, too, the formulation of brand new types of internal administrative procedures and accounting and statistical controls. Hence, the operational requirements of the railroads demanded the creation of the first administrative hierarchies in American business. (1977: 87)

Of course, the expansion of the railroads had a significant impact on the development of all types of businesses, the availability of reliable and in-

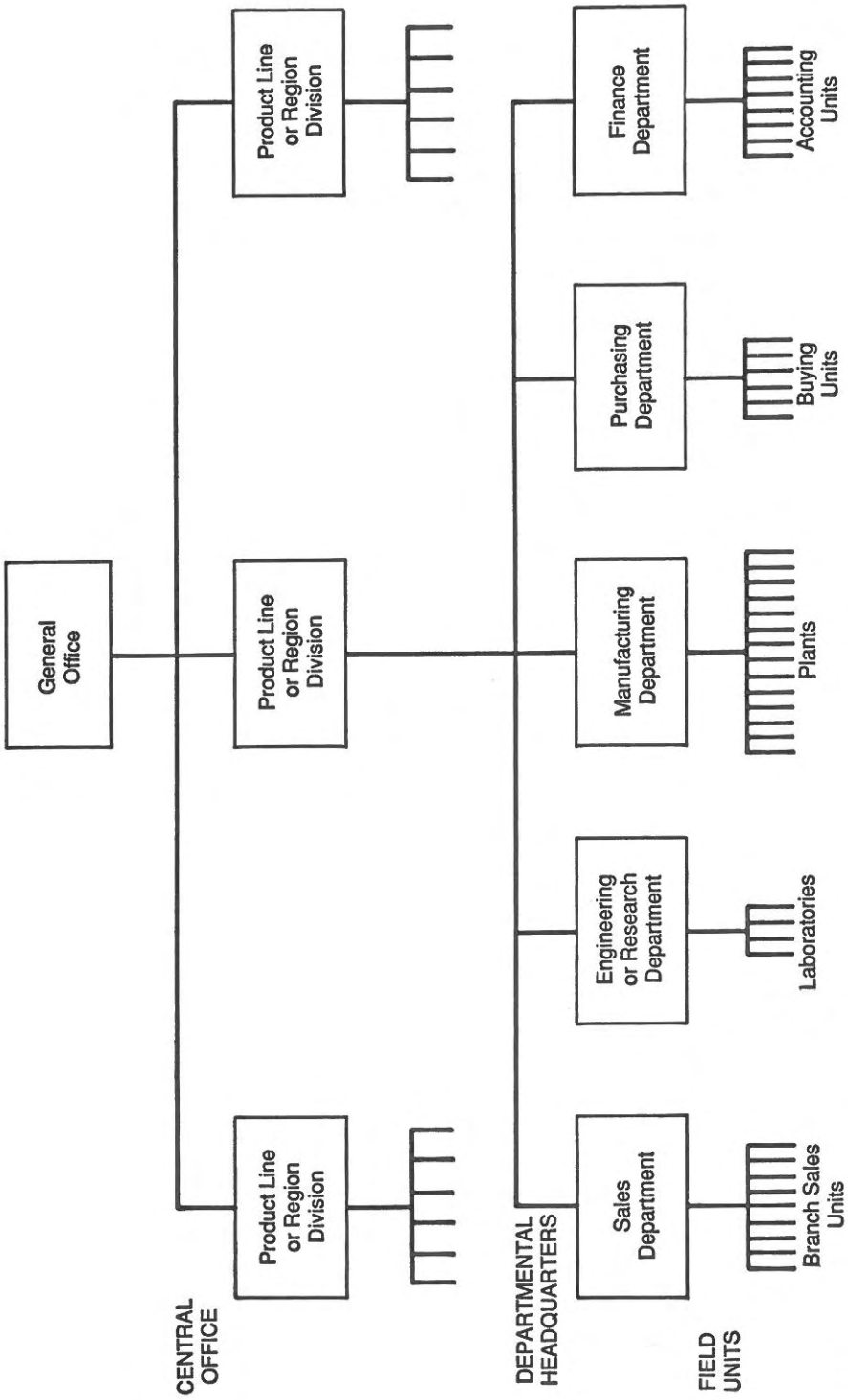

FIGURE 10–1
The Multidivisional Structure. *Source*: Chandler, 1962, p. 10.

expensive transportation enabling them to vastly expand their input and output markets.

Thus, phase three, lasting from the turn of the century to the First World War, witnessed the filling out of existing product lines as firms continued to expand. And, in order to ensure the continuing and efficient use of their resources, firms began to diversify, moving into related fields that would capitalize on their technical skills and marketing contacts.

In the fourth phase, following World War I, a few major companies that had diversified and were attempting to manage several related product lines found it necessary to reorganize in order to ensure the efficient employment of their resources. The new form that emerged was the "decentralized" or multi-division (M-form) structure, whose chief advantage was that it supported the clear separation of strategic from operational decision making. Day-to-day operational and tactical decisions were delegated to managers at the divisional level; longer-range strategic decisions were located at the general-office level (see Figure 10–1).

Firms can undertake horizontal mergers in order to increase the size of their markets, or vertical mergers in order to incorporate more phases of the production or distribution process and still fit comfortably into a unitary structure. However, as the firm begins to diversify its products and attempts to enter markets related or unrelated to those presently served—as it expands its *scope* rather than only its scale—it will benefit from moving into a multi-divisional form (Chandler, 1990). This is the sense in which Chandler insists that a firm's structure should be suited to its strategy. He argues that:

> Unless structure follows strategy, inefficiency results. This certainly appears to be the lesson to be learned from the experience of our four companies [du Pont, General Motors, Standard Oil, and Sears, Roebuck]. Volume expansion, geographical dispersion, vertical integration, product diversification, and continued growth by any of these basic strategies laid an increasingly heavy load of entrepreneurial decision making on the senior executives. If they failed to reform the lines of authority and communication and to develop information necessary for administation, the executives throughout the organization were drawn deeper and deeper into operational activities and often were working at cross purposes to and in conflict with one another (1962: 314-315)

Chandler argues that, given a diversified strategy, the new multi-divisional form is superior to the unitary form because it frees some officials from the tyranny of daily operational decisions and allows them to concentrate on positioning the organization in its environment and determining the proper mix of product lines and markets and thereby the allocation of resources among divisions. The M-form is also particularly well suited to supporting a multinational strategy, in which numerous divisions offering the same general product lines are situated to take advantage of multiple national markets (see Vaupel and Curhan, 1969; Tsurumi, 1977).

Chandler's general predictions receive empirical support from research by Rumelt (1986), who examined changes in the strategy and structure of a random sample of 100 of the 500 largest U.S. corporations in 1949, 1959, and 1969. Rumelt devised a set of categories to characterize

company strategy, ranging from single business through dominate business to related businesses to unrelated businesses. During the period of study the number of diversified corporations more than doubled, the percent of firms carrying on related or unrelated business strategies growing from 30 to 65 percent. With respect to structural change, during the same period, the percent of firms employing a product-division (M-form) structure increased from 20 to 76 precent. Diversification strategies were strong predictors of structural form, particularly during the 1949–1959 period. Contrary to ecological assumptions, "the vast preponderance of the change in the distribution of organizational forms among the 500 was caused by firms changing their form of organization rather than exiting and being replaced by firms with different structures" (Rumelt, 1986: 65).

And in a later, more extensive study, Fligstein assembled a data file containing information on 216 large U.S. firms spanning the period 1919 to 1979. His sample contains the 100 largest nonfinancial corporations in existence during each of three periods: 1919-39, 1939-59, and 1959-79. His analysis reveals that whereas less than 2 percent of these corporations had adopted the multi-divisional structure before 1929, over 84 percent had done so by 1979. Again, Chandler's central predictions were confirmed:

> Industries where product-related strategies dominated, like machine, chemical and transportation industries, adopted the MDF [M-form] in large numbers relatively early; while industries that were more likely to be vertically integrated, like mining, metalmaking, lumber and paper, and petroleum, adopted the MDF later and to a lesser extent. (Fligstein, 1985: 386)

While the spread of M-form structures generally parallels the development of diversified strategies, institutional forces also appear to be at work. Thus, Rumelt (1986) reports that, after 1959, business firms regardless of strategy moved to adopt the M-form structure because "divisionalization has been accepted as the norm" (p. 77). Similarly, Fligstein (1985) observed a mimetic effect beginning in 1939 "whereby firms in industries with other firms who have already changed to the MDF are more likely to do so" independent of firm strategy. Rumelt concludes: "The data gave strong support to Chandler's proposition that 'structure follows strategy," but forced the addition of 'structure also follows fashion' " (1986: 149).

Williamson (1975: 132-54) points out that Chandler's historical account of the problems accompanying diversification and the structural solution to these problems is consistent with predictions generated by the transactions cost framework. He argues that the principal problem created by diversification is that it creates increasing complexity and uncertainty—this time *within* the organization rather than in the environment—up to a level that exceeds the information-processing and decision-making capacity of the managers. The structural development that occurs is one that simplifies the informational and decision situations by clearly differentiating between the long-range policy decisions to be handled by the general office and the short-run operational decisions to be determined at the divisional level.

In Chandler's terms, the general office is responsible for *strategic* decisions, the divisions, for *operational* decisions. Strategic decisions determine what business one is in. Chandler stresses major choices, but strategic decisions are better viewed as a continuum: from modest changes in product/service mix—for example, a hardware store must decide whether to include garden supplies or lumber; a hospital, whether to provide long-term care or emergency services—to major changes involving a move into a different industry—for example, an automobile company decides whether to manufacture boats; a hotel corporation, whether to diversify into managing movie theaters. In all cases, strategic decisions involve a choice of domain(s). They determine the nature of the organization's technical core—or how many different kinds of technical cores will be included within the framework of the organization. In traditional organizations, strategic and operational decisions are made by the same individuals; in M—form structures, they become differentiated.

The individual divisions (or "strategic business units" or "profit centers") within the M-form structure present the interesting case of operating on the interface "between market and hierarchy." On the one hand, they are subject to the authority system of the parent organization; on the other hand, they are expected to effectively compete against other providers in a given market. Williamson (1985) emphasizes the advantages of these forms as central office executives, who make decisions about whether or not to continue, enlarge, or divest a given division, can make use of competitive market information—how well the unit is doing in competition with other providers—as well as information obtained through audits and other hierarchical control systems. By contrast, Eccles and White (1988) point out that the transactions costs associated with exchanges between devisions are often higher than those between independent units. This is because managers of divisions must ascertain for any given transaction whether firm-wide criteria or division-specific criteria are to be employed. In some situations, managers will be rewarded for minimizing costs by purchasing outside the company; in other situations, they will be expected to be a "team-player" and purchase inputs supplied by other divisions within their own company, even though these are more costly than those available outside the company. The presence of a hierarchy can distort the operation of market processes.

The more that the central office of an M-form company is divorced from the specifics of the work performed by the individual divisions, the more it must rely on financial indicators of performance. The internalization of capital markets is yet another way in which the modern corporation attempts to reduce, for its constituent units, the uncertainty of the environment. Thus, in important respects, the emergence of the *conglomerate* firm represents a further extension of M-form logic. Conglomerate firms are those containing divisions engaged in unrelated businesses: the diversification spans industry groups, not simply product lines. But, as Williamson notes, its development builds logically on the M-form structure:

> Once the merits of the M-form structure for managing separate, albeit related, lines of business (e.g., a series of automobile or a series of chemical divisions)

> were recognized and digested, its extension to manage less closely related activities was natural. (1985: 288)

In such firms, divisions are treated primarily as profit centers: the prime criteria for their continuation and support is their current or future profitability, and the general office functions as an (internal) capital market, by which cash flows are directed to high-yield uses.

Evidence increasingly suggests, however, that such unrelated business forms are problematic. Rumelt's (1986) empirical assessment of Chandler's strategy–stucture thesis was among the first to report that the highly diversified, unrelated business corporations performed less well than those that, in Peters and Waterman's phrase (1982), "stuck to their own knitting." Rumelt reports his growing awareness of the limitations of a structure that segregates operational from strategic decisions. He expresses concern regarding:

> the unanticipated side effects of this structure: the financial orientation it imposes on general management, the way planning systems in diversified firms drive out subtlety, and the lure of exciting large-scale acquisitions and mergers to senior managers suffering the ennui of a move from an operating job to a headquarters position. (Rumelt, 1986: ix)

Viewing business corporations in exclusively financial terms, rather than as productive systems for creating goods and services or as employment systems for allocating and coordinating the efforts of workers, has proved to be contageous. During the 1980s, a rash of corporate "raiders," taking advantage of new financial instruments such as "junk bonds" and less restrictive antitrust enforcement, have attempted to buy controlling shares in corporations judged to be undervalued, unseat existing managers, and sell off the more profitable divisions (see Coffee, Lowenstein, and Rose-Ackerman, 1988). Managers, in turn, have fought back with a variety of exotic defenses—poison pills, shark repellents, greenmail payments—that have solidified their own position, but have not improved the productive capacity of the corporation (see Davis, 1991).

The movement of U.S. corporations from related into unrelated business ventures can be explained not only as an attempt to reduce uncertainty by diversifying and spreading risk but also as a response to changes in the regulatory environment. Fligstein calls attention to the role of the state—a major actor in the institutional environment of large corporations—which responded to increasing concentration in product lines within industries by passage in 1950 of the Celler-Kefauver Act. This act together with subsequent court decisions curtailed corporate efforts to increase market share within the same industry, and in effect forced corporate expansion to occur in product-unrelated areas—that is, through conglomerate strategies. Thus, Fligstein (1985; 1990) suggests that the shift to conglomerate forms was the adaptive response of expansionist-oriented firms to governmental restrictions imposed on earlier, successful product-related strategies.

From single to multiple forms The widely held assumption that bigger is better, that all the advantages are on the side of bringing more and more

activities and resources under the control of a single hierarchy, has begun to give way to the recognition that important strengths are associated with alliances or loose confederations of smaller and more flexible forms. We discussed in some detail in Chapter 8 the diverse types of bridging mechanisms available to organizations wishing to develop strategic alliances. Some of these mechanisms—for example, mergers—involve changes in the ownership and in the formal boundaries of organizations, but many—for example, contracting and cooptation, and entering into associations—do not. The latter, looser types of connections have gained in popularity in recent years, and have begun to receive more research attention.[8]

Analysts have observed that varying combinations of small, independent, but interdependent firms have been able to successfully compete in many types of markets with larger corporations. Developments in information technologies as well as the increasingly specialized nature of consumer markets has helped to create conditions favoring more flexible production regimes. Long-linked technologies are ill-suited to provide customized goods or to respond to rapidly changing consumer tastes. Examples of successful small-scale firms range from family-based textile manufacturers in Japan (Dore, 1983) to firms producing engineering components and motorcycles in Italy (Brusco, 1982). Piore and Sabel (1984) point out that such complexes of flexible workshops are embedded in and supported by some sort of broader institutional base, often developing out of kinship ties or some kind of municipal or regional political structure. Such arrangements encourage cooperative behavior and allow longer term relational contracting to coexist along with competitive practices. Such alliances or "network" forms provide yet another viable form of organizing "between markets and hierarchies" (see Powell, 1990).

Roughly parallel developments have occurred in the public sector. During the past two decades, the range and variety of organizational forms and relations in the public sector have greatly increased. Traditional government agencies, exercising public authority and supported by tax dollars, have been joined by hybrid forms such as government corporations and government-sponsored enterprises, that attempt to build in various types of market controls. Moreover, more and more governmental agencies contract out particular tasks to private companies, both for-profit and nonprofit forms, in the belief that competition among such providers will improve the efficiency of governmental services (see Brooks, Liebman, and Schelling, 1984; Savas, 1982).

In short, the earlier dichotomy between markets and hierarchies, as well as the related distinction between private and public, is not very helpful in describing existing organizational forms. And alliances of smaller organizations, including mixtures of public agencies and private firms, are under some circumstances a viable alternative to large-scale corporations and public bureaucracies.

[8]Ghoshal and Bartlett have pointed out that multinational corporations may be more appropriately analyzed as interorganizational networks than as unitary organizations. Formal control devices are often greatly attenuated, giving rise to "extreme subsidiary autonomy" because of the "large physical and cultural distances between the owner and the owned units" (1990: 607)

CONNECTING THE CORE AND PERIPHERAL STRUCTURES

Tight and Loose Coupling

Much of what passes for organizational structure consists of varying types of mechanisms for controlling the behavior of participants. Hierarchy, formalization, centralization, modes of coordination—are all devices to help ensure that the organizational managers can shape and influence the behavior of other participants charged with carrying on the production activities of the organization. Indeed, a primary justification for the existence of managers is the impact of their ideas and decisions and designs and plans on the behavior of other participants. Many accounts of organizational structure—or, alternatively, many types of organizational structure—emphasize the tight coupling of managers and performers' behavior. Managers decide, performers implement; managers command, performers obey; managers coordinate, performers carry out specialized tasks. Organizations or segments of organizations of this type certainly exist, particularly in situations in which work activities have been divided and routinized. Rational system analysts emphasize this view of organizational structure.

By contrast, early natural system analysts, with their interest in behavioral rather than normative structures, looked more carefully at the operation of these supposedly tightly coupled systems and failed to observe the presence of the taut command systems described by the textbooks in administrative science. Rather, their studies revealed that workers were reluctant to accept close supervision and likely to develop protective work-group mechanisms or understandings with their supervisors that allowed them some leeway and breathing space in defining and meeting requirements (see Roethlisberger and Dickson, 1939; Roy, 1952; Gouldner, 1954; Rushing, 1966*a*). The control systems were less tightly coupled in operation than in theory.

All formal structural devices, however, do not connote tight coupling of activities. Decentralization, delegation, professionalization, even the creation of the staff-line distinction—these are mechanisms for ensuring *some* coordination and control but also for legitimating and supporting the exercise of discretion. They build in flexibility and encourage initiative in the technical core of the organization and so reduce its dependence on and its responsiveness to hierarchical directives. Moreover, as Parsons (1960: 65–66) pointed out when he distinguished among the technical, managerial, and institutional levels of organization, a qualitative break in the line-authority relation exists at the points where the three levels connect (see Chapter 3). Parsons argues that only within a level can a superior directly supervise the work of subordinates and assume responsibility for it, since differences in the nature of the work performed at each level are too great to permit direction of the lower by the higher levels. Thus, board members functioning at the institutional level would not be expected to exercise direct, routine line authority over managers but to grant them considerable freedom in exercising their managerial responsibilities; managers, in turn, would not ordinarily exercise direct line authority over the technical functions of workers. In short, the functions performed at each level are seen to be relatively distinct and not readily linked to one another. Thus, even

the relatively conventional views of rational and natural system theorists recognize the presence of considerable loose coupling as an important structural and operational feature of most organizational systems.

Meyer and Rowan (1977) take a more extreme view of the possibilities of loose coupling in organizations. They suggest that organizations in institutional environments will be inclined to selectively *decouple* their formal structures from the activities carried on in their technical core. The rationalized myths that provide meaning and legitimacy to the formal structures often do not provide clear and consistent guidelines for technical activities. The result is that the organization conforms closely to the ritually defined meanings and categories supplied by the environment but does not attempt seriously to implement them at the operational level. For example, Meyer and Rowan argue that educational organizations adhere closely to the ritual categories of education: "There seem to be centralized and enforced agreements about exactly what teachers, students, and topics of instruction constitute a particular school" (1978: 84). But at the operational level, there is little organizational coordination or control over instructional activities. These activities are delegated to teachers, and there is little or no attempt to evaluate and control their performance—either hierarchically or collegially—or to collect and use data on outputs, such as student-performance scores, as a means of improving their performance.[9] The solution of decoupling is particularly effective where environmental rules impose conflicting requirements on organizations. Thus, schools may be simultaneously required to give special treatment to educationally handicapped children but at the same time to "mainstream" them, not segregate them from their fellow students. Organizations can adapt to conflicting demands by creating appropriate programs and offices at the administrative level that can create the required reports, but then decoupling these offices from the operational level.

In a closely related discussion, Marshall Meyer (1979*a*) argues that changes in organizational structure can serve as an imporant signaling mechanism to the organization's constituencies. For example, the creation of an office for affirmative action can signal to interested parties an organization's commitment to the goals of this program independently of whether or not affirmative action policies are pursued. Meyer points out that such signals are taken seriously by outsiders because changes in structure are highly observable and consume resources (unlike pronouncements of goals or policy statements, which are relatively inexpensive and hence discounted), but are still much less costly than actual changes in behavior together with the imposition of inspection and sanctioning procedures to ensure conformity with the new program.

[9]As Meyer and Rowan note, the problem is not typically the absence of data on student outputs:

> Schools use elaborate tests to evaluate pupils and to shape the course of their present and future lives. But the same data are almost never aggregated and used to evaluate the performance of teachers, schools, or school systems. (Some data of this kind are made available for school and district evaluation in California, but only under the pressure of the state legislature, not the local school system.) (1978: 88-89)

The arguments of these institutional theorists are novel because they suggest that the formal structures of organizations have meaning and importance *regardless of whether they affect the behavior of performers in the technical core*. Formal structures can symbolize meaning and order. And, as Meyer and Rowan have emphasized, organizations that devise structures that conform closely to institutional requirements "maximize their legitimacy and increase their resources and survival capabilities" (1977: 352)

Organizations in both technical and institutional environments engage simultaneously in tight and loose coupling activities, but in different directions. Meyer, Deal, and I summarize the contrasting strategies:

> Organizations arising in connection with technical flows closely control and manage them. Their structures act to regulate the flows, to buffer them from uncertainty, and thus to insulate them in some measure from external forces. . . . The intent is to decouple technical work from environmental conditions so that it can be more tightly managed by the organization.
>
> By contrast, institutionalized organizations closely integrate their own structural arrangements with the frameworks established by the larger institutional structures. In doing so they tend to buffer their structures from the actual technical work activities performed within the organizations. . . .
>
> Thus the technical organization faces in toward its technical core and turns its back on the environment, while the institutional organization turns its back on its technical core in order to concentrate on conforming to its institutional environment. (Meyer, Scott, and Deal, 1981: 152-53)

Managing Up and Down

It is certainly obvious that over the course of this century, organizational forms have become more and more top-heavy. As Bendix (1956) and others have pointed out, the proportion of administrators to production workers has grown continuously throughout this period (see Chapter 1). A number of factors contributing to this result have been described in previous portions of this volume: the augmentation of the hierarchy to increase the information-processing capacity of the organization as the tasks performed become more complex and uncertain; the elaboration of managerial and staff positions in response to the need to buffer core departments and build connections with other units in the task environment; the incorporation of representatives from external units at the managerial or institutional level in order to relate more adequately to these interests, either as exchange partners or symbolically.[10] All of these developments imply the growth of peripheral roles and structures in relation to the technical core. However, only some of them orient the managerial level in and down toward the activities of the technical core. Many direct their attention up and out to the larger social and political environment. Managers of today's organizations must devote as much time and energy to "managing" their environments as to managing their production system.

[10]In addition to these changes in the "numerator," important changes in the "denominator" have also transpired. The number of production workers has continuously declined in many industries because of technological developments substituting capital equipment for labor.

Marxist theorists point out the close, interdependent connections between control arrangements within organizations and political systems in the wider society. Economic enterprises always rest on a political base. Whereas the prevailing rhetoric in capitalist societies stresses that enterprise is free and independent from state interference, Burawoy (1985) argues that political regimes within firms and in the wider polity are always linked. Capitalist systems differ from state socialism not in the absence of connections but the directness and visibility of those connections that do exist (see also Carroll, Delacroix, and Goodstein, 1988).

When the environment is heavily institutionalized, managers have their work cut out for them. Although, as we have already noted, Meyer and Rowan (1977: 345) suggest that "it takes only a little entrepreneurial energy to assemble" the relevant components—roles, rules, rituals—which are "littered around the societal landscape," to assemble these components is one thing and to fully mobilize them is another (see Chapter 7). Tilly (1978: 69) has proposed that the level of mobilization is a function of the product of two factors: the value of the resources acquired and the probability of "delivering" them when needed. He further suggests that the variables affecting delivery include "the extent of competing claims on the resources involved, the nature of the action to which the resources are to be committed, and how organized the mobilizing group is" (p. 71). It is apparent that many of the resources managers acquire in order to adapt to institutional requirements incorporate elements—whether professional roles or legal rules—that are subject to many competing claims, and are not likely to be readily assimilated or mobilized in the service of organizational objectives.

These conditions help to account for Meyer's assertion that as the larger societal structures become more "rationalized," individual organizations attempting to operate within them become less "rational."

> Modern rationality has a vastly expanded jurisdiction, and many fewer aspects of society are organized in other ways. All these rationalized perspectives enter into the life of typical formal organizations, which contain and must legitimate the rationalistic perspecitves of citizen-members, representatives of various occupational perspectives, carriers of bodies of authoritative knowledge, and organized representatives of a variety of external perspectives that penetrate the organizations and have some sovereign standing. It is exactly this rationalization of so many aspects of society that limits the rationality of formal organizational structure: modern formalized organizations are built up around the acknowledgment of the external legitimation, definition, and control of their internal processes. (1983: 269)

In this fashion, modern organizations "look less like rational organizations than holding companies incorporating various institutionally defined packages" (p. 262). The packages can be acquired and exhibited, but are not readily mobilized in the service of specific goals. The increasingly rationalized institutional structures to be found in modern societies constitute a normative exoskeleton that both supports and constrains its constituent organizations.

SUMMARY

This chapter has examined some of the factors affecting the larger structure of the organization: the extent of its bureaucratization, centralization, formalization, and differentiation. Although the characteristics of the organization's core technology influence its peripheral features, the latter also respond to other forces, in particular, the organization's size and its task environment. A number of empirical studies show that larger organizations are more highly differentiated and more formalized than smaller organizations. However, these studies also reveal that larger organizations tend to be less bureaucratized and centralized in their decision-making structures. It is suggested that reductions in bureaucratization occur because of administrative economies resulting from the managing of more of the same type of work, although these savings are counteracted and may be offset by increased administrative costs associated with greater differentiation—the costs of managing different kinds of work. Decentralization is both necessary, because of information overload at the top caused by increased size and differentiation, and possible, because formalization promotes consistency of decision making. Technology also affects the characteristics of peripheral structures; in particular, the division and routinization of work are associated with higher levels of differentiation, formalization, and bureaucratization, but the delegation of work to more highly skilled personnel is associated with the opposite structural effects. Whether the effects of size or of technology dominate in determining structural features of organizations cannot be determined from existing studies: longitudinal studies designed to test explicit causal models based on better samples of organizations are required.

The peripheral structures of organizations are also affected by the buffering and bridging strategies employed by organizations in relating to their task environment. Associated with all of these specific techniques are structural modifications—additions of new roles and departments and representatives of external interests. Open systems map critical features of their environments into their own structures as a major adaptive strategy. Structural reorganization is also associated with organizational growth. A prime example of such reorganization is the shift during the first half of this century in many major corporations from a unitary to a multidivisional structure. Recent developments suggest, however, that organizational growth has important limits; under some conditions alliances linking a number of smaller, independent organizations out-perform larger corporations.

The extent to which managerial units control and coordinate work in the technical core varies by type of organization but has probably been overstated. Considerable looseness of coupling has not only been observed in most organizations in the behavior of supervisors and workers but is legitimated by many types of formal arrangements. Recent analysts have called attention to some of the adaptive features of loosely coupled systems—whether the coupling involves boundary units relating to specific environmental segments, connections among boundary units, or connections between boundary and core units. The symbolic importance of structure has also been noted. Changes in structure at the institutional or managerial level are symbolically important whether or not they are associated with changes in procedures or behaviors within the technical core.

Managers must expend as much time and energy in relating to environmental demands as in directing the internal affairs of the organization. Balancing and reconciling—as well as buffering and segregating—are the primary administrative tasks in contemporary organizations.